CHEMICAL & METALLURGICAL ENGINEERING

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CHEMICAL & METALLURGICAL ENGINEERING

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Finis to Ford's Offer For Muscle Shoals

COMMITTEES in both houses in Congress have done well to reject Mr. FORD'S offer for Muscle Shoals. The attack was concentrated on his offer of the small sum of $5,000,000 for the nitrate plants and a demand that the power project be leased to him for a term of 100 years. As we have pointed out repeatedly in these columns, these two items of the Ford offer were sufficient to cause its rejection.

It is seldom that a Congressional committee gets as deeply into the details of a technical subject as the Senate Committee on Agriculture and Forestry delved into the intricacies of the Ford plan. The report by Senator NORRIS analyzed the situation in great detail. Not only does he show the impossibility of favoring Mr. FORD with a 100-year lease while other lessees under the federal water power act are limited to 50 years, but he proves quite conclusively that the $5,000,000 offered for the nitrate plants could be recouped almost immediately from the sale of the government's equity in the Gorgas steam plant and of surplus property which was never used and which is not necessary to the operation of the plants. Further, he analyzes the financial phases of FORD'S offer and shows that not only would the government not be reimbursed for the principal sums advanced but would receive less than 3 per cent interest on the money required to complete the great Muscle Shoals power project.

The Ford offer and all others having been rejected, Mr. NORRIS comes forward with a plan of his own which reverts to the original scheme of operation by a government owned and controlled corporation. As we intimated some weeks ago, this completes the cycle of proposals for the disposition of Muscle Shoals and brings us back to the original starting point. Mr. NORRIS proposes that his government corporation shall complete the power project and operate the nitrate plants for the production of fertilizer. He will be sure to meet much opposition from those who object to putting the government into business, despite his plea that it is just as proper for the government to operate power and nitrate plants as it is to maintain battleships and perform all of the functions necessary to keep government property in repair. The majority of his own committee is opposed to the measure and it is not likely to receive serious consideration at this session of Congress.

Speaking for the minority of the committee that favors the Ford offer, Senator LADD has prepared a report in which he draws the deadly parallel between the features of FORD'S proposal and Senator NORRIS' plan for government ownership and operation. His principal argument in support of Mr. FORD is that acceptance of his proposal will terminate the heavy expense under which the government now labors in the maintenance of Muscle Shoals and will, in addition, benefit the agricultural industry of the country by industrial research in the production of fertilizers. These advantages, coupled with a vision of the great industrial developments that Mr. FORD will bring about at Muscle Shoals, constitute in the minds of Senator LADD and his colleagues a sufficient reason for letting Mr. FORD have the project on his own terms. Senator LADD sees no reason for quibbling over such details as a 100-year lease and the small price to be paid for the nitrate plants. In short, the burden of the minority report is that the Ford offer should be accepted in spite of its obvious shortcomings because it is the only offer that has been made for the power project and nitrate plants as a whole. Leaving government ownership and operation out of the question, the minority report does not successfully meet the objections to FORD'S plan.

The Seniority Snag In the Railroad Strike

ONE of the unfortunate features of any strike is that the original issues may soon be lost to sight while extraneous matters assume unwonted importance. That is precisely the situation in the railroad strike and is the present cause of practically all the controversy going on among the government, the railway executives and the striking shop crafts.

But if the matter of seniority is extraneous to the original purposes of the strike, it has nevertheless become the one clear-cut issue. It is the one point in the settlement of which a definite principle is involved. The other matters are of a kind subject to compromise, but when the President asks the railway executives to agree that all striking employees shall "be returned to work and to their former positions with seniority and other rights unimpaired" he is asking them to violate a principle on which, in our judgment, there should be no yielding.

Neither the railway executives nor the striking shopmen can come before the public with clean hands as far as their compliance with decisions of the Railroad Labor Board is concerned. Both are guilty of ignoring the authority of this government agency and are justly subject to public censure. But the seniority issue was created by the strikers and not by the executives, and the decision of the executives not to restore the strikers to their jobs with seniority and other rights unimpaired was made for them officially by the Railroad Labor Board. In other words, the successive steps by which restoration with seniority rights has become the principal issue of the strike show clearly that the executives are in a very strong position in refusing to accept the President's proposal. It requires little stretch of the imagination to foresee the consequences

of accepting the government's conditions for calling off the strike. If strikers are to be permitted to disrupt transportation and industry and threaten the welfare of the country and then, after having caused untold inconvenience, loss and damage, return unpunished to their jobs as though coming back from a brief holiday, neither the railway executives nor the Railroad Labor Board nor any other agency will be able to settle future strikes by filling the strikers' places with new workers. If the executives are now required to tear up as a scrap of paper their promises to protect and reward faithful employees and new employees, then they will indeed do violence to every principle involved in the matter and work a gross injustice on the men who made it possible to continue transportation service in spite of the strikers. Regardless of the merits of the original points in controversy, there should be no yielding by the railway executives on the seniority issue.

Quack, Quack!

SCARCELY a week passes without the receipt of printed matter describing some marvelous liquid or powder which will turn merchant bar into finest tool steel, which will double the mileage of a Cadillac if two drops of the stuff are placed in the carburetor, which will convert the purchasable variety of grape juice into extra dry champagne over night, or which will cure warts, corns, sprains, abrasions, cancer and falling hair. Later in the fall we expect to get some more literature advocating the use of some other stuff, "the result of extensive and exhaustive research, experiments, tests and demonstrations by scientists," which will make the mixture of slate and culm to be sold this winter burn like the cleanest anthracite.

That all of these varieties of "Nulife" are sold in large quantity is sure: so many new ones are constantly appearing. And doubtless they are often sold to men who pride themselves with knowing something about their business. A fair share of the purchasers must also be those who have never been victimized before and who must learn from experience, and in no other way, that there is no virtue in nostrums. Furthermore, it is a standing demonstration of the salesman's premise that it is more important to know the psychology of the buyer than anything about his real needs or the nature of the article offered for sale.

Chemical analysis would in most cases show that the largest portion of "Nulife"—and we offer our apology if this pet word meaning all kinds of quack remedies has been previously appropriated—might be water, sand, charcoal, fuel oil or some such cheap ingredient. But not everybody has the opportunity nor the desire for analyzing "Nulife" and finding out whether he could not make it up for himself for about one-tenth the selling price of the "secret composition." Those who have such opportunities ordinarily have wholesome respect for law, and become instantly suspicious of lurid claims, knowing that in the struggle with Mother Nature you can't get something for nothing.

But it would be just as well to spread the word about. There now seems to be a flood of substances on the market by which "wrought iron or bessemer steel of low grade is converted into the equivalent of costly crucible steel as far as physical properties are concerned." A rule-of-thumb or thoughtless heat-treater might easily believe it, remembering the changes he can make in a piece of really high-grade steel by heating and cooling. But he must be warned by more intelligent friends that the metal he has in hand did not appear by merely waving a wand and muttering cabalistic words. It is the result of most extreme care on the part of a hundred men throughout a dozen difficult operations, from the selection of ore and raw materials through steel making, casting, rolling, annealing and inspection. If he will think a little he will agree that all this infinite care, wrapped up in a little piece of flawless metal, cannot be replaced by daubing some dope on some junk and following the printed directions.

Thirty years ago the late Dr. HENRY M. HOWE was encountering these same ideas, and what he said is very much to the point: "You cannot make a bad beefsteak good by the cooking; you can cook it better or worse, and it will be worse or less bad beefsteak, but always bad. On the other hand, you can easily spoil a good beefsteak by bad cooking. Now, just as cooking is to food, so is heat-treatment to steel."

When you dine at LUNG TONG'S chop house in Jaurez, you use a liberal amount of chili sauce and red pepper, and for a very good reason; but at the Waldorf you do not need to drown one of OSCAR'S patties in mustard to make it tasty.

Universities Must Compete With Industry for Leaders

EVERY so often we publish in our personal column a note to the effect that Prof. BLANK has resigned his professorship in the X. Y. Z. University to accept a position in chemical industry. The receipt of another announcement of this kind, soon to be published, was coincident with that of a letter deploring the fact that such a man could not be saved for educational work.

Technical schools must supply trained men to industries and in addition must build up research in the fundmentals of science. This is no mean task. It should enlist the best talent and genius which the country can produce, and yet these announcements continue to come to us of a brilliant young professor entering industrial work. What is wrong? Surely no one will blame the young man, full of enthusiasm, ideas and red blood; eager for the prizes which industry is able to offer. His ambition is the motive power of this country. On the other hand, one cannot blame industry for trying to get men who have developed qualities of scientific leadership.

The problem, then, must be solved in some other way. Young men entering educational work find much that is attractive. The opportunity for real service is a repaying thing. The life, removed from the fret and nag of competition, has charm. The opportunity to do constructive research is appealing. But once the full professorship is attained—and this usually comes early in life—there is no further promotion. No opportunity is presented for achievement comparable to that offered by other professions—law, medicine, even the ministry. What more, then, is needed to keep men of promise and achievement in educational work?

A correspondent who desires to be nameless and for whose opinion we have the highest regard has presented a suggestion which is constructive and sane. He recognizes at once the futility of trying to persuade industry to refrain from tempting such men. Quite rightly he says: "Initiative and leadership are not fostered by neglect and lack of appreciation." His

remedy is to create an incentive to remain in teaching. Let the prizes be sufficiently alluring to attract the man with initiative and leadership. Compete with industry for such men! And the method? Establish a number of foundations paying salaries of $25,000 and over—very limited in number so that a comparatively small per cent could ever hope to attain the goal. Such prizes would serve as real incentives to hold men in educational work.

Our correspondent continues by discussing some of the restrictions. Such foundations should be reserved for men of unusual accomplishment and need not be filled because there happens to be a vacancy. They should not be pensions and should be held only during the productive period. One should be reserved for each of the great fields of educational work—pre-eminence in teaching or in research.

This idea is fundamentally sound. Great men appear where there is great opportunity. If we would keep great men in educational work we must create great opportunity. Nor is this derogatory to the able men already engaged in educational work. Thank heaven for those that stay, even though their reward is not much better than that of the vast majority of mediocre men who clog the profession, impart facts and leave the student lethargic and dispirited. But there is still the exceptional man to provide for, and we suggest that those in authority in our leading universities take the initiative in establishing foundations that will yield salaries commensurate with those of industry. Competition will get and hold the best men.

Commodity Prices and Business Confidence

IT IS rather an interesting point that in the past 10 years we have escaped a "panic" on two or three occasions when one was expected. There was rather a widespread belief late in 1912 and in the fore part of 1913 that a panic was due at about the middle of the latter year. No panic occurred. Perhaps the inception of the World War might have been counted on for a panic, but there was none. While it was not the general view, there was a feeling in some quarters that the ending of the war would be followed by rather serious financial troubles, but we had nothing of the sort.

The experience referred to was not the experience in the previous history of the United States. There had been numerous panics, and they had, of course, been unexpected, for the panic that is seriously expected can scarcely happen, because men provide against the condition. Individually they set their houses in order.

Remarks are now being made here and there that the foundations for a panic are being laid, hope being expressed that things will not really go so far as to make trouble. The reference is not to a financial panic, for it is now generally accepted that under the Federal Reserve system a financial or money panic is practically impossible. What is thought of is a sort of "buyers' panic," which would cause buyers suddenly to cease buying, thus precipitating industrial depression.

The trends of the times need to be studied carefully, for by them one should be able to determine whither we are moving. It is a matter of advancing prices, but all upward trends in prices are not provocative of panic. The causes and circumstances are to be considered. If a price has been lower than it should be in relation to a reasonable cost of production with an efficient operation, an advance is healthy. The advance removes ground for doubt and makes the seller prosperous, and prosperity spreads.

One of the tests that may usually be applied is the test of whether the thing that advances is being produced economically and efficiently. That uncovers the cause of the present doubt, the fear that there may be a "buyers' panic." The principal uneasiness at present is due to the fact that some workmen are being paid higher wages than the economic conditions of the country would warrant for all workmen. Furthermore, these workers are not doing a fair day's work. That there are such cases in the building trades is well known. Common labor is being paid approximately 50 cents an hour in some districts. That is too high relative to wages in general, since it would be impossible to establish $1,200 a year—which is what 50 cents an hour amounts to—as a minimum wage, with gradations upward according to the relative value of the services rendered. The wages would exceed the national income—i.e., the goods are not available for spending so much.

It need not necessarily impair the general economic fabric, however, if the high costs are sufficiently limited in extent. If we see many things coming to be produced under disadvantageous conditions, or at unfair cost, we shall then have reason to fear a reaction.

Production Efficiency In the Chemical Industries

EVER since business began to work back to normal conditions following the disruption caused by the war, it has been borne in upon the wise executive that he would best be able to meet competition and conduct his business profitably by giving attention first to the efficiency of his production methods. This fact was emphasized in a most striking manner by a survey of waste elimination conducted by the Federated American Engineering Societies. It has also been stressed less strikingly in the public utterances of business leaders and in the programs of industrial and technical societies.

But what are the factors that influence production efficiency? Waste is but one of them, and while it may have been true that the elimination of waste in all its forms offered many of our industries the quickest route to profitable operation, there are other equally important elements that must still be given the closest attention if production is to be made on the most efficient basis. Some of these factors are mechanical in their nature and some economic, while others fall into the broad classification of human relations. The theme is a large one and obviously cannot be covered in detail short of several large volumes. We shall attempt, however, in our forthcoming Chemical Exposition issue, Aug. 30, to cover the essentials of the subject in a series of articles that have been contributed by recognized leaders and specialists. More than a score of topics will be treated, ranging from the mechanical problems of material handling and automatic control, through the economic subjects of cost accounting, the business cycle and problems of administration, to the human elements of the selection and training of workers, the preservation of their health and happiness, and their relations with their employers. The issue has been in preparation for several months and we believe its excellence is such as to deserve special commendation, in advance, to our readers.

Readers' Views and Comments

An Outline of the Uses of Lime

To the Editor of Chemical & Metallurgical Engineering

SIR:—Referring to D. M. Liddell's further discussion of "An Outline of the Uses of Lime" appearing in the July 19 number of *Chemical & Metallurgical Engineering*, I wish to point out that in writing that article I did not consider lime as being CaO. I believe it is quite generally agreed now that lime is not CaO. A very satisfactory definition for lime is that given by S. V. Peppel, published in Bulletin 4 of the Geological Survey of Ohio, which is as follows: "Lime is the material obtained by the calcination of a stone in which carbonate of calcium is a predominating ingredient." It follows from this definition that a dolomitic limestone calcined either partly or wholly would be considered lime, and that is the sense in which the term was used in the above-mentioned article.

The chemical reaction referred to was that between the magnesium oxide in the lime and the magnesium chloride in solution.

As to the question as to whether or not the use referred to is a use of limestone or lime, I think there could be no question that it is a case of using both. It can be considered a lime product, however, because it can be made from lime by proper chemical treatment.

NATIONAL LIME ASSOCIATION.
M. E. HOLMES,
Manager, Chemical Department.

Washington, D. C.

Should Engineers Be Licensed?

To the Editor of Chemical & Metallurgical Engineering

SIR:—Your invitation for comments on the effect upon chemical engineers of laws requiring engineers to be licensed leads me to point out that many of these laws do not recognize the fundamental difference between much of the work of civil engineers and that of the other major branches of engineering. A large percentage of civil engineers are engaged on public works, either on salary or as consultants, and the apparent purpose of many license laws is to require a proof of fitness of men in responsible positions in such work. With the great mass of mechanical, electrical, chemical and mining engineers, the condition of their work is different, for they are the technical elements of groups having financial, legal, executive and sales elements in order to function properly in meeting legitimate business and industrial conditions. It is the group and not the individual which has become the natural unit in these fields of engineering. For example, a central station company does not go to an individual for information about large turbo-generators, but to the groups, or companies, designing and building them.

The condition that will exist in New Jersey after April 8, 1923, unless the license law is repealed which becomes effective then, serves to illustrate the dangers of license legislation to most engineers. After that date no person may practice or offer to practice professional engineering in that state, unless licensed, for more than 30 days in any calendar year, without incurring danger of being fined \$100 to \$500 or being imprisoned for not over 3 months or both. "Professional engineering," the law says, "means the practice of the professional engineer who through technical knowledge gained by education and experience in one or more branches of that profession initiates, investigates, plans and directs the application of the resources of nature to the use and convenience of man; and who represents himself or herself to be such an engineer through the use of the term engineer with or without qualifying adjectives, or through the use of some other title implying that he or she is an engineer."

There is no provision by which an industrial or engineering company may perform professional engineering work in the state except upon its own premises. It cannot give engineering advice in its own name, representing the combined knowledge and judgment of its specialists; all the prestige and good will inherent in that name is wiped out. It must give this advice in the name of some individual, if at all, which is plainly contrary to sound public policy and good economics. A few instances will show what the effect of such a law upon the chemical industry will be.

Assume that a gas company in New Jersey wishes to build a large addition to its works and prefers as a result of experience to turn the design and construction over to some company specializing in such work. Under the law this cannot be done; only individuals can be licensed in New Jersey and there is no provision for companies practicing through them.

A New Jersey textile mill finds that its dye works must be reconstructed and enlarged. Its plant engineer is able to design the structures and plan the general layout, but he wishes the help of dye makers and equipment builders in laying out the details. The only way these companies can co-operate is in the name of the individuals they delegate, whereas the textile company wishes the co-operation in name as well as in fact of the employers of these men, as it is company knowledge and guarantees and not individual opinions without guarantees which it is looking for.

A company having mills in several New Jersey cities finds that the drums of one of its boilers are becoming pitted inside. For years it has referred such troubles to the boiler builder, which has one of its works in the state, where it maintains an organization of engineers and chemists engaged exclusively in studying operating troubles with boilers. But under the new license law all this valuable information is sealed up and can be utilized, if at all, only by a roundabout process.

The New Jersey license law is the most narrow and inelastic yet passed. It compares with the Pennsylvania law about as sulphuric acid and milk. The Pennsylvania law has been in effect but a short time, yet a suit to test its constitutionality has already been brought. When the industries of New Jersey find out what the license law of their state does to them, if it is impartially enforced and not used merely for oppression of companies out of favor politically, it seems reasonable to expect a vigorous uprising against such legislation as well as a resort to the courts. JOHN M. GOODELL.

Upper Montclair, N. J.

The Proper Status of the Engineering Profession

By R. A. Hart
Senior Drainage Engineer, U. S. Department of Agriculture
In Collaboration With
H. W. Clark and S. A. Roberts*

The Ideals Toward Which Individual Engineers Must Strive if Their Profession Is Ultimately to Take Its Place on the Same High Plane as the Other Professions Are Set Forth and the Shortcomings of the Present Day Engineer Critically Examined

The status of a profession can be measured only by the standing and standards of the individuals who represent it. The measure, of necessity, must be composite, with due regard both for the highest and the lowest factor, but especially for the mean of the general body of factors.

Were we to measure our profession by its most renowned exponents we could justly feel that a proper status already has been attained, one not surpassed by any other profession. Unfortunately, however, this is not proper nor possible and we must regard the status of such exponents as more or less individual but as establishing, none the less, a status that is attainable and must be attained by the profession.

Engineering a Learned Profession

When the proper status is attained the engineering profession will be truly a learned profession.

This means that engineers will acquire a broad liberal education second neither to that of medical men nor of the representatives of the bar. Most engineers realize already that the purpose of obtaining an education is to enable one to live—not merely to make a living—to fit one to enjoy the more durable satisfactions of life, and that a rigid technical education, however thorough and comprehensive, leaves much to be desired. Engineers will be better grounded in the humanities, they will have a better command of the mother tongue and they will be able the better to express themselves and impress their thoughts upon others whether in small or in large groups. They will know more of the history of mankind, more of the fundamentals of political economy, of sociology and of psychology, for they will realize more fully than now that engineering has to do not only with material resources and sources of power but with man himself, both as a factor in production and as the fundamental motive of inspiration for the whole engineering process.

Needless to say, the purely technical education will not be neglected in the search for broader culture. Indeed, the scientific and technical phase will be intensified, but at the same time broadened. Due to the rapid evolution of the profession in America during the past half century, the educational system has been compelled to readjust itself from time to time, being swayed first in one direction by a doctrine of practical training that would have made a trade school of the college, then in the other direction by a doctrine of cultural development that would have ignored the utilitarian aspect to a harmful degree. Our present system is a compromise that provides for too much specialization on the part of the engineering student. The engineering undergraduate education of the future will provide for a more thorough grounding in the fundamentals of science and of engineering unmodified by adjectives. Specialization will await the period of post-graduate study or the development under conditions of actual practice. Newly-fledged engineers, unless they have had the wisdom to interpolate practical experience between their years of technical study, will be of less value to employers for a period, but eventually they will be worth more to employers or clients, to civilization and to themselves.

Finally, the engineer of the future will reach a higher aesthetic development. He will come to appreciate and enjoy the finer things of life and he will not feel out of place in association with those whose lives touch these things more intimately.

When the proper status is attained, engineering will be recognized as a learned profession by engineers themselves, by the members of the other learned professions, by the law, and by laymen generally.

It has been but two generations since engineers were generally regarded as nothing more than high-grade mechanics. Engineers did not take particular exception to this classification and even today there are engineers whose perspectives do not define a higher status. Such engineers, admittedly, constitute a small minority, but there is a much larger proportion of the membership of the profession whose attitude toward culture in general, particularly toward the necessity for a proper regard for accuracy, effectiveness and clarity, not to say beauty, in the spoken and written word, constitutes a depressing factor in the struggle to advance the status of the profession. Many engineers have no more realization of the seriousness of their deficiencies in liberal education at the close of their college careers than they had of the desirability of such education at the beginning of their technical education, and as a consequence make no attempt to correct the deficiencies by personal effort after entering practice. Many others, realizing their deficiencies, conclude that it is too late to apply a remedy. Most engineers sincerely believe that their professional work leaves no time for perusal of anything but technical matter, newspapers and general periodicals; others find no time even to continue their technical development save through experience.

Recognition Must Be Sought

It may be said that the engineering profession has already been admitted to the honored company of the learned professions by the consent and acknowledgment of the membership thereof. It is realized that an engineer must have had a training equivalent to that of a doctor or a lawyer, for example, and that the nature of his subject matter is such as to require commensurate mental equipment, but the impression is firm that the training is special, highly technical and narrow and the recognition of the profession as a learned profession involves a mental reservation. One of our goals must be to eliminate this reservation.

From the legal standpoint, the engineer has been in a peculiar position. He has had the protection neither of the mechanics or material man's lien, with respect

*Messrs. Hart, Clark and Roberts were members of a committee of the Engineering Council of Utah which prepared this article.

to remuneration for services rendered, nor that afforded to the members of most of the other professions through examinations for the bar, license laws and certification. The engineer has occupied a twilight zone in which he has been left at the mercy of his employer or client on the one hand and of the pseudo-engineer on the other. When the proper status is attained the engineer will have ample legal protection.

In America particularly, the laity has not accorded the profession the rank acknowledged even by the other professions and great effort must be expended before the proper recognition is secured. In France, the engineer is a gentleman and a scholar and is recognized as such. In England the engineer is frequently of the aristocracy. Even in Mexico there is no possibility of confusing the engineer with the driver of a locomotive as the one is called *inginerio* and the other *maquinista*. When the proper status is attained the layman will distinguish the engineer from the engine-driver, he will discover in the civil engineer more than the runner of lines and the driver of stakes; he will requisition the services of the engineer more and more, and he will retain the engineer on the basis of ability and service, not on the false basis of relative price. He will come to recognize the time element as non-essential and that the element of service or of opinion is paramount.

Development of a High Professional Sense

When the proper status of the engineering profession is attained it will be found that engineers generally have developed a high professional sense controlling their individual relations with the public, their individual relations with each other and their collective activities.

Engineering is essentially honest. It deals with immutable laws and the engineer discovers very early in his career that he cannot go counter to these laws and succeed. Whatever his natural inclination may be, he gets into honest habits. By the time he reaches the status where his opinion rather than his services is in demand, he has developed a very jealous regard for his reputation and this serves as a further protection. He finds that he is a dispenser of justice. He is not an advocate for either party in a controversy but his duty it is to expose the truth. It appears that engineers in general have come nearer attaining the proper status in this than in any other phase of the question. It is not to be denied, however, that there are men in the profession who fail to rise to the standard now established—men who will sell a favorable opinion for a fee; men who will advocate a wrong cause; men who will permit their judgments to be warped for a consideration or, perhaps, by insidious suggestion.

Curiously enough, while engineers in general have established a very high standard with respect to their fiduciary relationship, the same high professional sense does not apply to their relations one with another. This is largely due to the fact that engineers are more or less individualistic and the rapid economic development, particularly in America, has resulted in a keen competition in achievement which was worthy and beneficent but which, under conditions of stress evolved into a keen competition for work to do, and this latter competition has produced some very unworthy aspects. This is, no doubt, a passing phase and in the interest of the advancement of the status of the profession it should be firmly kept in mind that every injury done by word or act to a member of the profession is an injury to the profession and therefore to the instigator himself. The first electrical engineer said, "We must all hang together or assuredly we shall all hang separately."

The ethics of the engineering profession as yet are unwritten and this may be the reason why they are often ignored by engineers in their dealings one with another. Whether or not it is a reason, it is not an excuse, since there is a written code of ethics, available to every engineer, that covers the situation. The code comprises only eighteen words and may easily be memorized. It is as follows: "Therefore all things whatsoever ye would that men should do to you, do ye even so to them."

Engineers are beginning to act collectively. If the proper status of the profession is to be attained speedily, such collective activity must be on a high plane. There must be nothing that savors of trade unionism. Every endeavor to advance the status of the profession must be of the highest order. Engineers must adopt an absolutely unbiased attitude with respect to the adjustment of the differences between capital and labor. In the matter of the promotion of legislation, engineers must operate with an eye single to the good of all and not serve one class or interest to the detriment of another.

When engineering attains the proper status there will be more business in engineering and more engineering in business. It is said, perhaps justly, that engineers do not possess a high commercial sense; indeed, many lack even the element of good common sense. Commercialism is distasteful to most engineers. This is not an uncommon characteristic of professional men generally, but with engineers particularly it is essential that economics shall have a full measure of regard. Engineers are notoriously poor salesmen, even of their own services. If engineers are to measure up to their opportunities they must develop the commercial instinct to an extent where they can sell ideas in the first place and then properly direct the application of the ideas to the end that the product shall fill an economic want in an economical manner. Engineers must come to realize that the most effective instrument of engineering is the almighty dollar and that it is fully as essential to know the powers, purposes and limitations of this instrument and how to use it effectively and efficiently, as that of any other or all other instruments of the profession.

Broader Power and Authority Involved

It seems almost unnecessary to say that the men in this world who are doing the things should have more to say about *what* is to be done, *when* it is to be done and *how* it is to be done. The fact remains, however, that engineers do not have a sufficiently effective voice in these matters. Generally the broader plans are laid, the organizations are effected, the policies adopted, the ends to be attained decided and perhaps even the financing arranged before the engineer is called upon to produce results. Somehow, handicapped and circumscribed as he is, he generally produces the results. How much better would it be for all were the engineer to play an important if not dominant part in the general plans and their collateral phases.

Great administrators have come to lean very heavily on their engineers and this is gratifying so far as it goes, but the question naturally arises, Why should the organization be such that the head must lean on the

lieutenant? Evidently the engineer is able not only to stand alone but to bear up under the weight of his chief. If the engineer suffers a deficiency that justly condemns him to the secondary position, let him correct that deficiency and the whole organization will profit by the readjustment.

But while great administrators have had the wisdom to lean heavily upon their engineers it may be said, in general, that administrators of smaller caliber and boards of directors generally fail to do so. They are more inclined to lean upon their attorneys for counsel in matters of administration and finance. This is entirely proper to the extent of the legal aspects, but when it comes to the more or less practical aspects it is unfair to the attorney to require his advice, as he is unfitted usually, both by temperament and training, to give the most competent guidance and his legal reputation itself may suffer without warrant in the event of his practical adhortation being erroneous.

The accountant and the banker come in for a due share of consideration by administrators and boards of directors in matters of administration and finance, but here again there is a tendency to fail to recognize limitations. The good banker is the conservative banker. For him to lead would be fatal to the financial structure. He must go only so far as he is compelled. He is the governor on the engine of material progress, not the actuating power. The accountant deals with things as they are and it is his duty rather to proscribe than to initiate. The attorney has his being in precedent. He deals with a system of rules of action that are but the crystallization of public opinion. Crystallization involves a time element and it follows naturally that the law ever lags and never leads in the progress of the race. The attorney must ever look backward and yet backward. His thinking is *a posteriori* in consequence.

The engineer by nature and training and experience is fitted best to bring in the element of vision so necessary to progress. Progressive by nature, grounded in the immutable laws of science, experienced in their practical adaptation and application, possessed of a constructive imagination, gifted with a sense of values and proportions, trained in *a priori* reasoning, urged on by the highest traditions of his profession and blessed with a reasonable assurance, the engineer is destined to lead humanity in its upward and onward progression.

Activity in Public Affairs

When the engineering profession attains the proper status, engineers in general will play a more important rôle in the drama of public affairs. There will be an increased voluntary activity and there will be a greater call to service.

It is said that most engineers do not bother even to vote. Certainly they are much less active in political matters than is excusable. It is the exception to find an engineer rendering his voluntary service in a strictly public capacity. He prefers to be a doer and to leave the talking to those who cannot do. Experience has shown this to be disastrous both to the engineers and to society. Some of the reasons for this aversion have been referred to. They will disappear with broader culture. There is an element of inertia involved, however and this must be overcome by individual and collective effort.

The voluntary intensified activity will be accompanied by a call to service on boards, commissions and in governmental affairs generally. It will become a custom if not a law that at least one member of every board or commission touching the public in any practical manner will be an engineer and that boards and commissions having to do with engineering matters strictly will be composed of engineers. The spectacle of the highway commission of a great commonwealth, a commission dealing entirely with engineering problems in the broadest sense, being made up of non-engineers will not be witnessed.

The minds and talents of engineers will be brought to bear upon the solution of the perplexing problems of civilization that have so far defied the best efforts of politicians, legislators and statesmen and if past performance by engineers in other matters be employed as a safe guide, we may confidently expect the same satisfactory results.

Compensation

The compensation of the engineer is twofold and is both direct and indirect. The direct compensation is the satisfaction which comes to him from doing something worth while and from successful accomplishment. Such compensation is limited only by the degree of his enthusiasm in his work, by the sincerity of his desire for rendering service and by the integrity of his application to his task. Thus the control is largely in his own hands.

But the engineer is one of those happy mortals who receive pay for doing what they like to do. Such pay constitutes the indirect compensation of the engineer and it is essential that it be sufficient in amount so that the engineer may live a well-rounded life in order to continue his service to mankind. It is this indirect compensation to which we refer when we say that the engineer is undercompensated. When the proper status of the profession is attained there will be no criticism to offer on the score of compensation.

A consideration of proper compensation for engineers involves a question of nature as well as of amount. A young engineer is valuable particularly for his services and there is some justification for the employment of a time basis in connection with compensation. The mature engineer, on the other hand, is valuable largely for his opinion based on experience and his judgment, which involves mental quality and caliber. In neither of these does the time element function. A right opinion is valuable regardless of whether it is rendered instantaneously or as a result of much calculation and consideration.

The time unit serves fairly well for the activities that involve manual operations. It fails utterly in the case of the service rendered by mature engineers. The value of the service rendered is the only satisfactory measure of his compensation. Many examples might be given to illustrate the fact that a good engineer saves at least the cost of his fee on each project.

Effort should be directed more toward a change in the nature and the basis for engineering compensation than toward advance in rates and classification. The one goes hand in hand with the whole movement to advance the status of the profession, while the other runs counter to it and may operate to its detriment. Proper compensation will follow as a matter of course when the proper status has been attained.

Summing up then, it has been shown that when the proper status of the engineering profession has been

attained, the profession will be truly a learned profession and universally will be recognized as such. Engineers will acquire a broader culture and a higher refinement. Their undergraduate scientific training will be broader and specialization will await the postgraduate period. Engineers will have a better legal status than now and they will develop a higher professional sense in connection with their individual relations with the public, their individual relations one with another and their collective activities. They will find it necessary to develop a higher commercial sense and to become much more active in public matters. The question of compensation will adjust itself to the status.

Determination of Gases in Metals

BY HAROLD LESTER SIMONS

(Contribution from the laboratories of the Magna Metal Corporation.)

A VERY common source of trouble in metallurgical work is that the resultant product is "gassy." Naturally, before any remedy may be applied, it is necessary to know just what gas is causing the trouble; and, furthermore, it is desirable to be able to ascertain the nature and quantity of gas in any given sample of material in order to determine the efficacy of the treatment resorted to in an attempt to remove it.

It is obvious that even under the best of conditions for analysis (and correspondingly worst condition of material) the amount of gas present must be very small indeed—a fact which any proposed method must take into account.

Hempel[1] advocates the use of a hollow mercury-filled drill in which the gas is collected. This procedure has the objection that a small amount of air is always obtained with the gas sought, this being likely to result in some confusion. Furthermore, although cast iron does not amalgamate with mercury, most other metals do. This will obviously render the procedure difficult.

Ryder[2] has evolved a method which is apparently an excellent one; but it involves employing the metal in filament form and is, therefore, unsuitable if the original material is in somewhat large pieces.

The fact that mercury does amalgamate with most metals suggests that, by means of a somewhat large quantity thereof, a solution of the metal in question may be formed and the liberated gas pumped off. Accordingly, the apparatus illustrated diagramatically in the accompanying figure was constructed and has been employed most usefully in connection with work in this laboratory.

A is a 200-c.c. round-bottom pyrex flask with walls about 1 to 1.5 mm. thick and top flared. The flare is used as a mercury seal where it makes joint with a ground-in stopper of ordinary soft glass. *B* is a tube which slants downward and meets the stopcock *C*. (Incidentally, all stopcocks and joints are mercury sealed.) *D* is made of capillary tubing which extends almost to the bottom of flask *E*, which is filled with purified mercury which has been boiled for some time in order to free the flask from air. *F* is a water-cooled condenser which may, however, be replaced by a long glass tube if desired. *G* is another mercury-sealed stopcock and *J* is a Geissler tube for spectral examination of the gas. It is connected to the apparatus by a bent and bulbed tube in order to catch any stray drops of mercury. *K* is a two-way mercury-sealed stopcock which leads on the one hand to a Toeppler pump and on the other to *I* (a source of pure oxygen), which is a bulb filled with pure potassium permanganate covered with glass wool. *H* is merely another bulb filled with phosphorus pentoxide to dry the oxygen.

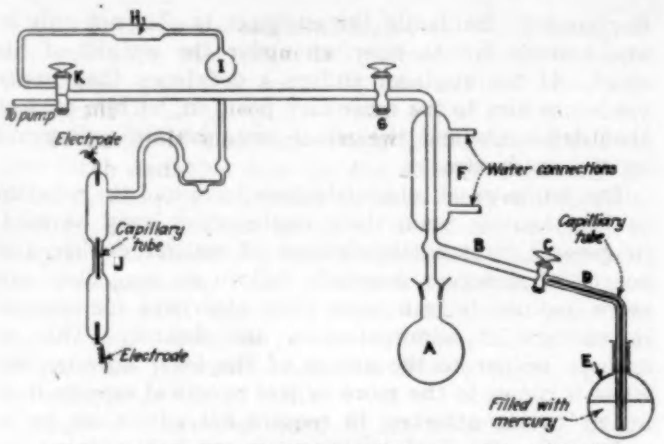


FIG. 1—SKETCH OF APPARATUS FOR RECOVERING GAS FROM METAL

In practice the apparatus is flooded with pure dry oxygen (obtained by heating *I*) and exhausted by means of the pump. *C* is then opened very slowly and mercury permitted to rise until it reaches the middle of tube *B*. Dry oxygen is then admitted to the system, after which *A* is removed and the metal samples inserted. As much as 75 g. of certain high-magnesium alloys in pieces about 2 x ½ in. have been used.

A is again fastened on and mercury placed in the seal. The complete system is now evacuated to about 1 mm., when it is again flooded with oxygen. The pumping is now continued until a spark refuses to pass in *J*, save with the greatest difficulty. Even then no spectral lines should be observable. It may be remarked in this connection that hydrogen (and nitrogen) lines are rather persistent and serve as a good criterion of complete evacuation. Since the current from an induction coil is not a pure sine function, one electrode of the Geissler tube remains colder than the other and retains more adsorbed gas. Therefore it is best to reverse the electrical connections frequently.

Stopcock *G* is now closed and mercury permitted to run in slowly by opening *C*. The rate at which this is done will depend upon the metal under examination. It is desirable to warm the flask with a bunsen flame. If the metal dissolves with difficulty or is present in large quantity, flask *A* is filled about two-thirds with mercury and stopcock *C* closed. The temperature may now be readily raised to the boiling point of mercury under atmospheric pressure. This elevated temperature greatly facilitates solution.

The flask and its contents are now permitted to become fairly cool before proceeding further—for if this is not done, the mercury will vaporize so rapidly that it will condense in all parts of the apparatus. Now open stopcock *G* slightly (*C* and *K* must be closed) and then shut it. Examine the gases spectrally at this time. A glass tube of about 25 c.c. capacity with a stopcock at its upper end is now placed over the mercury-sealed exit tube of the Toeppler pump. The tube and stopcock are completely filled with mercury by suction and supported in this position.

Everything is now in readiness to collect the gas by operating the pump after making connection through

[1] "Methods of Gas Analysis," by Hempel (trans. by Dennis) (1912), p. 18 *ff*.
[2] *J. Am. Chem. Soc.*, vol. 40, p. 1656 (1918).

K. It is well to examine the gas spectrally at intervals in order to note any change in its nature. This examination also serves to detect a leak. Gentle boiling serves to render easy the liberation of the entire quantity of the gas, which after collection can be examined by the ordinary methods of gas analysis.

As the work performed at this laboratory is of a very specialized nature, no advantage would be had by publishing results of isolated analyses. Many tests have indicated, however, that consistent results can be obtained by the method. For instance, a certain high-magnesium alloy, purposely made rather gassy, contained 0.083 c.c. gas per gram, which proved to be practically pure hydrogen by chemical analysis, although the spectroscope showed a trace of argon. Duplicate samples showed substantial agreement.

The author wishes to express his gratitude to Prof. Reston Stevenson of the College of the City of New York for his invaluable assistance and for the use of private apparatus in carrying out this procedure.

He also desires to extend his thanks to Andrew C. Ericksen of these laboratories for his most valuable assistance in parts of this work.

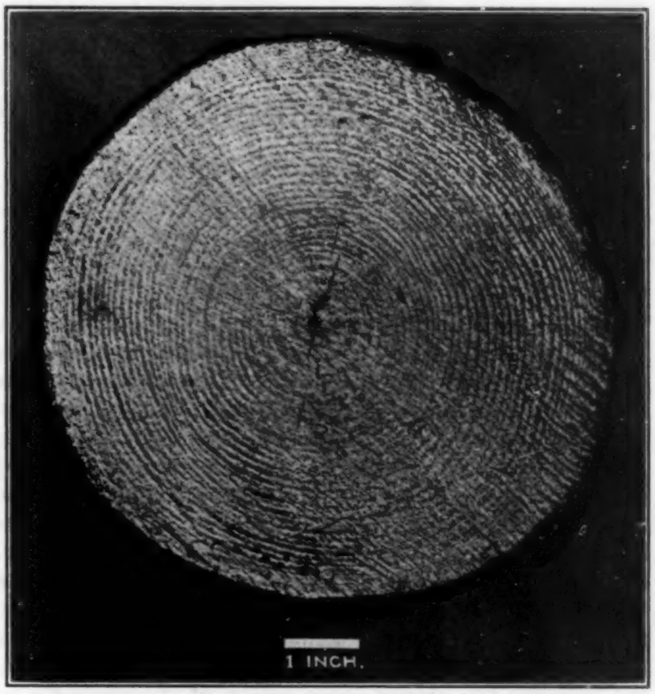
Paper From Southern Spruce-Pine

EXPERIMENTS recently conducted with the variety of wood known in the South as Southern spruce-pine are said to have demonstrated the value of the timber as a pulp wood for paper manufacture. Exhaustive surveys are now being conducted to determine the amount of timber available for newsprint manufacture and plans are being prepared for the erection of a paper mill on the Warrior River in Alabama, near Birmingham.

There are hundreds of square miles of the spruce-pine covering the hills and ridges throughout the northern and northwestern section of Alabama. The trees grow along the banks of the river down to the water's edge, and stretch for miles along the banks of the stream. It is estimated that there is enough timber standing to supply one or more large paper mills for 100 years. It is said that the trees reach the proper size for paper-making in about eighteen years. The trees grow to a considerable height; there is almost a total absence of heart and only a trace of rosin. The fiber is almost identical with that of Canadian spruce and a cord of the Alabama wood makes a ton of paper pulp, the yield being the same as with the ordinary spruce.

The proximity of the pine forests to the Warrior River means easy, quick and cheap transportation of the logs to the proposed mill, as well as a 20 per cent saving in freight to purchasers of the finished paper, due to the fact that the combination water-rail freight rate is considerably less than the all-rail rate. Experts declare that the wood can be delivered to the river at one-fourth the cost of delivering logs from the Canadian forests to the Northern paper mills.

The Southern spruce-pine has heretofore been considered a worthless product. Unfit for lumber and of a fibrous nature, it decays quickly and has found no practical use in the South. The foliage is very short and contains many cones. The bark is unusually thin, and of much lighter color than that of the regular yellow pine used for lumber. The trees grow only on the hills and knolls, being rarely found in the valley of southern Alabama nor where there is a surplus of moisture. Preliminary surveys indicate that the yield in the territory along the Warrior River will average from 10 to 20 cords per acre. It is believed that the present supply is sufficient to last a fair-sized mill for fifty years, but in view of the rapid growth of this species of tree the supply might be said to be practically inexhaustible. An interesting experiment to demonstrate the practicability of using this species of spruce for newsprint was recently conducted by the publishers of the Birmingham *Age-Herald.* A recent issue of this paper was printed entirely on stock manufactured from the Alabama wood. The timber was cut along the Warrior River, shipped to Niagara Falls and converted into print. The report from the mill which handled the wood was to the effect that it grinds as easily and has as good fiber as Canadian spruce.



CROSS-SECTION OF MATURE LOG OF SOUTHERN SPRUCE-PINE

The weight of the paper is 32 lb., and the breaking strength 11 lb. per square inch, thus conforming with standard specifications for newsprint.

Electric Pig Iron in Sweden

The Engineer for July 7, 1922, contains an unsigned article on "Electric Smelting of Pig Iron in Sweden," commenting on a late test of a pig-iron furnace of the conventional type. The furnace has a height of 13.7 m. over all, 38 cu.m. capacity, and produces 23 tons of pig iron per day. In the official test, one metric ton of pig required 1,749 kw.-hr. (theoretical 1,301; efficiency therefore being 74.4 per cent). Magnetic ore containing 67.3 per cent iron was used, P 0.006 and S 0.004.

It is pointed out that the exceptional purity of the Swedish ores (the average of the whole country's reserves is 60 per cent Fe) and the resulting slag volume (15 per cent of the iron produced) are great factors leading to the success of electric smelting. If the charge contains any considerable amount of sulphur, the sulphur in the pig iron is regulated with extreme difficulty —it varies with the temperature of the hearth and returns to normal very slowly. Another controlling factor is the cost of electric power and charcoal versus coke.

Quality Control in Cement Manufacture*

An Analysis of the Crucial Points of Portland Cement Manufacture and a Discussion of the Kind of Control Necessary at These Points to Produce Cement of High Quality

BY RICHARD K. MEADE
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CONTRARY to the general belief, the question of the quality of cement is more often a mechanical than a chemical problem, or rather perhaps one of the relation of the mechanics of the process to the chemical composition of the product. The connection between the chemical composition of cement and its physical properties is now so well understood that there are few instances where the poor quality of the cement is due to a lack of knowledge of what the chemical composition of this should be. Generally speaking, poor quality is due to circumstances which interfere with the attainment of the ideal composition by the chemist. In speaking of composition in this paper the term is not limited to the mere analysis of the cement, but includes the proper combination of the elements to form the so-called cement clinker.

PROBLEMS OF MANUFACTURING GOOD CLINKER

The problem of manufacturing good clinker in laboratory quantities is extremely simple. It is merely necessary to grind finely a properly proportioned mixture of argillaceous and calcareous substances and then to ignite the mixture to the point of incipient vitrification for a sufficient time to allow proper chemical combination of the elements composing the mix. All the details of the process are well understood by cement chemists—the proper relation to be had between the argillaceous and calcareous elements, the fineness necessary to secure intimate contact and the degree of burning to promote combination are all matters of common knowledge in the industry. When it comes to handling large quantities of natural materials and to manufacturing cement economically, however, the problem is vastly complicated. To begin with the raw materials, these generally vary considerably in chemical composition in different parts of the deposit and the method of accurately sampling and proportioning these materials is one of the most troublesome problems with which the cement manufacturer has to contend. The question of the degree of grinding is generally limited by the mechanical equipment provided and is always influenced by the question of economy. The problem of burning is much simpler than the other two and is usually merely one of securing experienced and conscientious kiln attendants.

These three primary operations of cement manufacture bear a general relation to each other. Some years ago the writer called attention to the fact that, assuming the chemical composition to be correct, there is a very definite relation between the fineness of the materials, the temperature of burning and the time at which the materials are subjected to this temperature. This relation can be best illustrated by means of a mathematical formula thus

$$F \times D \times T = C$$

In which F represents the fineness, D the temperature, T the time, and C clinker (a constant quantity). It will be seen that if C is a fixed quantity the others can vary among themselves and still equal C. Thus with a coarsely ground mixture, the time or temperature of burning, one or possibly both, must be increased to secure proper combination. Similarly if the time in the kiln is short this must be made up for by higher temperature or finer grinding.

If the fact that the composition of the mixture of argillaceous and calcareous substance can vary is considered, another variable is added to the equation. It is, of course, well known that it is much easier to burn low-lime cement than high-lime cement, in which case coarser grinding satisfies. In actual practice, the details of cement manufacture, therefore, are a general compromise to suit local conditions between chemical composition, fineness of grinding and degree of burning.

Fine grinding and harder burning as indicated above will tend to correct faulty composition in some instances. The importance of fine grinding of the raw materials and of proper burning are, of course, better understood and when these are the cause of poor quality the remedy is evident.

ABSOLUTE CHEMICAL CONTROL NECESSARY

My own experience indicates that the problem of making cement of uniform high quality is largely one of *absolute* control of the chemical composition of the mixture fed to the kilns. Occasionally the raw grinding or burning equipment is insufficient, but for the most part the failure to control the chemical composition of the mix has been responsible for the irregular quality of the product.

Chemical analysis of the cement does not always show the trouble, particularly when this analysis is confined to a sample representing a large quantity of cement, such as a bin of several thousand barrels or a day's run—because such a bin of cement may be the average of several hours of very high-limed and consequently unsound cement mixed with several hours of low-limed cement; the average of the two being often near the desired chemical composition but the physical properties of the resulting cement retaining something of the undesirable characteristics of both the high-limed and low-limed clinker.

Such a result is quite apt to occur in the dry process, where chemical control is generally a matter of examination of a mixture already made rather than of two materials about to be mixed. It is, of course, well known to most cement manufacturers that the routine tests of the dry-mill laboratory are post mortems rather than diagnoses. They are of no value so far as correcting the composition of the particular lot of raw material under examination is concerned, but serve as a guide to the making of succeeding lots.

By far the larger number of mills, both wet and dry, make their mix by means of what are, in the vernacular

*Paper read before the Portland Cement Association at Atlantic City, June 27, 1922.

of the industry, known as "readings." That is, samples of the mix are drawn from the grinding mills at stated intervals of time and in these samples the carbonate of lime is determined. If this is found to vary from the desired standard, no correction can as a rule be made in that portion of the mix which has already been prepared, and the test serves principally as a guide to the proportioning of succeeding lots, etc. When the mix is controlled by such a process, the chemist finding his mixture too high or too low in lime (as shown by the reading) decreases or increases his limestone to correct his proportions. In the dry process this often has the effect of sending his composition to the opposite extreme, with the result that while his low-lime and high-lime clinker will average properly very little of it is *per se* of correct composition.

In the wet process, however, an opportunity is generally given to mix the whole lot of ground material by combining the contents of several slurry basins in one large kiln feed basin and in this way the averaging is done before the kiln is reached and hence the clinker is of correct composition.

At many dry-process cement plants, the question of chemical control is largely one of good judgment on the part of the chemist rather than of chemical test. For example, let us cite the case where a limestone and shale plant is supplied with rock by one large steam shovel. The shale is regular but the various strata of limestone differ much in chemical composition. Added to this variation is also the fact that 3 or 4 ft. of clay overlying the limestone is not stripped from the latter but is blasted down with it. Deep well drills are used and the shots are large, each representing several months' supply of stone. All stone is sent direct from the shovel through crushers into a relatively small storage bin and the mix is controlled entirely by "readings" taken from the tube mill discharge. Let us suppose, as frequently happens, the shovel is working in the morning on clean limestone comparatively free from stripping. At noon, it encounters a limestone mixed with stripping and by night it has worked through the stripping and is back on the clean stone. What happens to the mix is this: Some time during the afternoon the sample drawn from the tube mill shows the mix to be overclayed and the chemist accordingly decreases the shale. The orders to make this change probably reach the raw mill about the time the shovel reaches clean stone again with the result that the next sample drawn from the tube mill will show the mix over-limed. At this mill, the mix would generally be wrong but for the visual inspection and good judgment of the chemist. This condition is by no means unusual and while probably not existing often in such exaggerated form, does occur in a more or less modified form at many mills.

Superiority of American Cement Evident

In my opinion, it is everlastingly to the credit of the American cement chemist that he can make cement *superior* to any in the world with the crude methods often supplied him. He may not be as "long" on theory as his English and German confrères, but for the exercise of good, hard common sense and rare judgment he has them both, to use a slang expression, "backed off the map."

So far as quarrying methods are concerned, the steam shovel and the deep-well drill are likely to stay, and it is also in most instances more economical to include the overburden in the blast rather than to strip. At the same time, it is evident that these three improvements in quarry efficiency have increased materially in most instances the difficulty of securing a uniform mix. The big blast throws down the entire vertical face of the quarry in one jumbled heap. If it served also to mix the various beds intimately it would be of advantage. Unfortunately the opposite is generally true and the beds remain almost as separate, but not as easily segregated after the stone is blasted down as when in the position left by nature. In the case of the old method of quarrying by means of 16- to 20-ft. benches, the beds were usually blasted down in some sort of order and could be quarried uniformly. The steam shovels also confine the stone supplied the mill to that obtainable from one or two points in the quarry, while with hand loading the stone can be obtained from almost the entire area of the quarry.

Lack of Uniform Overburden Presents Problem

If the overburden could be intimately mixed with the stone there would generally be no objection to its being blasted down with the stone. Unfortunately this result cannot often be obtained and the overburden usually lies over part of the rock only.

With these new conditions occurring in the quarry, provision must be made at the mill to take care of the irregular supply of stone and clay sent to the mill by the shovels. The influence of occasional variations in the composition of the raw materials are designed to be taken care of at most plants by storage bins of varying forms and sizes.

Usually the shale or clay supplied the mill, whether obtained by means of shovels or hand labor, is of regular composition. Sometimes with clay the moisture content needs careful supervision. A few mills use a calcareous shale in which the lime content varies over quite a range. The use of such shale always greatly complicates the problem of controlling the chemical composition of the mix by introducing two variables instead of one.

Storage of Stone and Prevention of Segregation

The employment of a large stone storage divided into two or more bins seems to be the most feasible method of securing a uniform raw material. In many instances, however, such stone-houses are poorly designed. If we place rock continuously on the middle of a pile and draw at the same time below from the center of this, we will obtain pretty much the same stone that is being delivered to the pile and very little if any mixing will occur. Even where the discharge is not directly under the point of filling this flow of material between the two points occurs. In designing a stone-house, therefore, this should be divided into at least two bins, although it is doubtful if anything is gained by numerous small tanks or bins.

Another action which should be kept in mind is the so-called segregation of materials in the bins. If a mixture of coarsely crushed limestone is fed from an overhead source into the center of a pile it will be found that the coarse material will roll to the outside of the pile while the fine material will lie where it falls. If the pile is tapped from the center, the first material drawn is almost entirely the fines while the coarse material is the last to be obtained. As the fine material usually contains the stripping and is always lower in lime than the coarse material, it will be seen that the composition of the material obtained when the pile is first tapped

will be much lower in lime than that of the last portion obtained.

Many plants employ what are termed blending bins, consisting of large tanks in which the coarsely crushed material is stored. My observation has been that these bins instead of blending, actually segregate, for the reason given above.

It has always seemed to me that the traveling crane and grab bucket afford excellent methods of storing limestone. With this outfit the material as crushed can be uniformly distributed over a large pile. There is no segregation of fines and coarse and the reclaiming can also be distributed over a large area. It is a simple matter for the chemist to work out for the crane operator a cycle of filling and emptying such a storage which will give uniform material and leave nothing to the judgment of the operator.

Another excellent storage is one consisting of several long rectangular and fairly deep bins filled by means of an overhead belt conveyor. This latter is in turn equipped with a traveling tripper. This tripper is so designed as to move at a regular rate slowly back and forth over the entire length of the bin and spread the material in uniform layers over this. If the bin is relatively narrow and the openings below are alternately to each side of the center line, the segregation between coarse and fine material is negligible where the stone is drawn from several openings.

For those who prefer a pan conveyor or bucket carrier to the belt conveyor, the buckets can be arranged to deposit the material at a number of points in the bin. No doubt, other methods of securing the same result are available. Where a silo storage is employed, if the number of bins is sufficient to permit it, better results will be obtained by filling or emptying a number of these at the same time by some such method as I have suggested, rather than to fill and empty in rotation.

So much for the form of storage. Another fact which should be borne in mind is that the finer the rock is crushed the better mixture will be obtained and the less segregation will occur in the bins. For this reason, I would suggest crushing the materials as far as practicable before storage.

Proportioning the Mix—Sampling and Measuring

For determining the proportions of the two materials where the mixing is done directly after the large stonehouse, two methods are generally employed. One is to obtain a sample of the contents of the bins of clay and limestone and mix the two as indicated by the analysis of this sample. The other is what is generally designated as the "reading" method and consists in mixing the two materials according to the results obtained from a determination of the carbonate of lime in the mix after this has been ground in the mill. In spite of the fact that it is apparently much the less scientific of the two methods, the second one will usually give better results. This is because of the difficulty of properly sampling material in large pieces mixed with fines and intermediates.

The only method of sampling such material which will give accurate results will be some system of crushing and quartering in several steps such as is used for ore sampling and this would involve an expensive sampling plant. As an illustration of such a plant, let us suppose that the material came from the crusher in a pan conveyor. Arrangement could be made to trip every tenth bucket into a small crusher which would crush to, say, 1 in. and under. The discharge from this crusher would then be sampled and the sample crushed to, say, ¼ in. This ¼-in. material in turn would be sampled and the sample crushed to 10 mesh. The fine material could then be sampled and this final sample ground to the necessary fineness for analysis. It will be seen that such an arrangement would involve handling quite a lot of material.

In a cement plant using 1,000 tons of stone per day the first sample would amount to 100 tons to be crushed to 1 in., the second to 10 tons to be crushed to ¼ in., the third to 1 ton to be ground to 10 mesh and the fourth to 200 lb. to be ground to laboratory fineness. It is doubtful if accurate results can be obtained with much greater fractions. It will readily be seen that the equipment necessary for such quantities is beyond that now available in cement mill laboratories.

The methods necessary for securing uniform rock at the mill are the same whether the wet or dry process is employed and the desirability of such a supply of rock of uniform composition is as great in the one process as the other. In the older wet process plants, provision was made for adding clay or marl as desired to the ground slurry before this was pumped to the kiln supply basins. Today, however, when necessary to correct the composition of the slurry, the general practice is to mix two or more tanks to give the desired results, so that as far as the mix goes, the two processes approach each other much more nearly than they did when the raw materials of the wet process were marl and clay. In the matter of chemical control, there are unquestionably much better facilities provided at most wet-process plants than there are in the general run of dry-process mills. When difficulties of controlling the mix to occur in wet-process plants, this is usually due to too few or too small slurry basins and kiln feed tanks or to improper or insufficient agitation.

Dry-Process Plants Need More Complete Control

The writer has always felt that the methods employed to control the mix at most dry-process plants are insufficient and that a system of correcting tanks planned after those of wet-process plants could be employed to advantage. If the grinding is done in two stages, such as with ball and tube mills, the use of two sets of tanks or bins is suggested; one set of at least four, and better, six or eight tanks to be placed after the preliminary mills (ball mills) and one set of four or more after the secondary mills (tube mills). The tanks in the first set should be sufficiently large to take care of at least four hours' run of the mill. The system should be provided with an automatic sampler so that the contents of each tank can be sampled as ground. Where ample rock storage had been provided to give fairly uniform rock, the four tanks could then be used in this manner. One tank would be filling, the second tank would be under test and the third and fourth tanks would be used straight, or mixed if necessary to give the proper composition. When analysis proved a tank to be of incorrect composition it would be necessary to so proportion the next tank that the two could be mixed so as to give a mixture of correct composition. The second set of tanks would receive the fully ground material and these should also be provided with automatic samplers. They serve as a further means of correcting the mix when necessary by blending the contents of two or more tanks as the pulverized material is sent to the kiln. The mixing here is not as thorough

as would occur when the two materials were ground but still fairly good mixing would occur when the screw conveyors were used to carry the mix from the tanks and considerable mixing would also be effected in the upper part of the kiln before the material began to form into balls.

Suggested Method

At some plants, it would no doubt be found most convenient to use such a series of tanks for mixing. That is, to grind the materials separately to 10 to 20 mesh before the mixing is done. In this case certain tanks would be set aside for limestone and certain tanks for clay and both materials would be sampled automatically and mixed according to the analysis of these samples. It is comparatively easy to secure an accurate sample of 10- or 20-mesh material, while it is extremely difficult to obtain anything which will properly represent material crushed only to 1 in. So that this system of sampling, analyzing and mixing will do with 10-mesh material but will not give satisfaction with 1-in. material. The statement that the finer the material the easier it is to sample accurately will hold good for all materials.

No doubt various modifications of this system would be devised to suit local conditions. For instance, at certain plants it might be found best to mix partly by analysis and then to do the correcting by adding to the contents of the tanks as drawn a small amount of clay or limestone ground to 10 mesh. I am not trying to outline a plan to be followed by all plants, but merely to indicate lines along which such a system may be worked out. The cost of operating such a system would be low and the initial investment small. I believe the saving in other lines aside from quality would pay for the installation and upkeep of the system. Such saving would include fuel required to burn over-limed mix, power to grind under-limed clinker, labor due to greater kiln outputs, greater life of kiln linings, etc.

Interdependence of Steps in Portland Cement Manufacture

In the earlier paragraphs of this paper, it has been shown how the various steps in the process of cement manufacture bear one on the other. From this it will be evident that if there are shortcomings in one step these must be made up for in the next. If the composition is irregular, the grinding of the raw materials must be carried to the degree of fineness necessary to give sound cement from the high-lime mixture as well as from the low-lime. Every chemist knows that where the lime is high, much finer raw grinding is required than where it is low or even normal. In order to make sure of sound cement, the chemist must therefore grind finer where occasional runs of high-lime material are encountered than where the mixture is constant. The proper fineness of the raw materials is therefore influenced to some extent by their composition.

The proper burning of cement is largely one of feeding the material and fuel to the kiln at a regular rate. If the composition of the mixture is constant, it is evident that if the material is fed to the kiln at a regular rate and the kiln is kept at a definite temperature and revolved at a constant speed, the resulting clinker will be uniformly burned. The trouble with the burning is, first, that the composition changes, requiring a higher temperature or a longer time in the kiln and, second, that the rate at which both raw material and coal are fed to the kiln is subject to violent and sudden fluctuations, or in other words, both coal and raw material "flood." Where trouble with the burning results, much of this can be eliminated by designing proper feeding arrangements for both raw material and fuel. The irregularities due to change of composition come gradually and can be kept up with, while the feeding of the raw material is usually sudden and the extra load of material occasioned thereby is hard to catch and properly burn. The arrangements for feeding slurry to the kiln, where this is done by positive means such as buckets and scoops, are excellent and something of the same sort of arrangement is desirable in the dry process.

Summary

The qualities most desirable in cement are soundness, strength and uniformity in the rate of setting and hardening. All are dependent to a marked degree on chemical composition, the fineness of the raw materials and the burning. These three steps are therefore the ones which must be under perfect control if quality cement is to be produced. The chemical composition should be regarded as the keystone of the arch. Unfortunately, it is the step least under control. While there are many plants where unsound or quick setting cement is a rarity, even here there might be an appreciable improvement in quality by a closer regulation of chemical composition. Most cement chemists are playing safe, as it were, rather than attempting to attain any ideals. Perfect control of the composition would enable them to make cements much higher in lime than they do at present, with the result that their clinker would be more easily ground and the resulting cement stronger and more uniform in setting and hardening qualities.

Iron and Steel Situation in Japan

Latest advices from Department of Commerce representatives in Japan indicate that the iron and steel industry has been adversely affected by the financial stringency and general depression which set in during April of this year. Prices have been unstable and weak, but as yet have shown only fractional declines. Stocks are increasing, while the volume of sales is narrowing. Despite the depression, however, Japan continues its purchases of iron and steel in considerable volume.

Imports of iron ore, pig iron, and iron and steel products into Japan during April amounted to 175,813 long tons, bringing the total of foreign iron and steel purchased by that country during the first 4 months of 1922 up to 686,047 tons.

In May of this year its purchases from the United States were 88,400 gross tons, or 5,000 tons more than in April.

Japan has always been a large buyer of United States finished steel products, and since November of last year has been our leading customer. In the year 1921 the Japanese market received 614,281 tons of rolled iron and steel, 566,722 tons or iron ore, 222,639 tons of pig iron, and 9,239 tons of scrap iron and steel. Of the rolled iron and steel tonnage, the United States supplied 59 per cent, and of the pig iron and scrap, 1,409 and 2,247 tons, respectively. In that year the United States furnished over 70 per cent of the 59,000 tons of rails imported by Japan.

The Native Paper Industry of Western China

BY H. K. RICHARDSON

PAPER has been manufactured in China since the beginning of the Christian era. Paper money is mentioned in the history of Szechuen as early as 960 A.D. Today this industry is carried on in much the same way as it has been for the past ten centuries.

Many different kinds of paper are made in the western provinces of Szechuen and Kweichow, of which four are of particular interest. These are:

1—Kou Pi Chih or bark paper, which is made from the paper mulberry, probably the original paper made in China.

2—Rice paper, so called, which is sliced from a pith.

3—Ts'ao Chih, or coarse paper, made from rice straw or reeds.

4—Chu Chih, or bamboo paper, made from young bamboo trees.

Each of these papers is made by a method more or less distinctive, so the manufacture of each will be given in detail.

KOU PI CHIH

The bark paper is made from the bark of the paper mulberry, *Broussonetia papyrifera*, a much-branched tree about 45 ft. tall with a smooth gray bark. Marco Polo in his "Book" states regarding the manufacture of this paper: "What they take is a certain white bast or skin which lies between the wood of the tree and the thick outer bark and they make something resembling sheets of paper, but black." Most of this paper is made today in Kweichow province, a region but little visited by white men, so there is little to add to the above description of the manufacture of this article. The process must have undergone some change, for this paper is rather gray, not black. It is the toughest paper obtainable in China. It is extensively used to wrap up rolls of silver dollars and to serve as the interlining between the fur and silk of the Chinese winter garments. In this latter case its tough texture prevents the sewed seams of the fur from wearing through the silk. This paper is considered by many to be the original "india paper," which actually was a Cantonese, not an Indian, product. The steamed bark of this tree finds use as string.

RICE PAPER

This variety of paper, known as rice paper to foreigners, is made from the pith of *Tung Ts'ao* or *Tetrapanex papyrifera*, a shrub similar to our common ivy. The beautiful and strong white pith of this plant is rolled against a sharp knife in a manner similar to the way a veneer knife is applied to a log of wood. The result is a large piece of very white absorbent paper, much in demand for artificial flowers and artists' painting paper. One whole street in Chengtu is given over to the making of artificial flowers and butterflies, for which a large supply of this paper is needed. Many are the colors shown, for the paper takes dyes wonderfully well. The slicing of the paper is a trade in itself and is handed down from father to son. Much skill is required for this operation. It is usually carried on in the quiet of the night hours when no noise distracts, for the concentrated attention of the operator is needed to preclude serious accidents.

FIG. 1—PITS LINED WITH CONCRETE FOR DIGESTING THE BAMBOO CULMS

TS'AO CHIH

This variety of coarse paper is made more according to modern ideas from (*a*) rice straw, *Oryza sativa l.* or (*b*) *Mao Ts'ao*, a reed of the species *Imperata arundinacea koengii* or (*c*) a mixture of the above.

The apparatus used to make this paper is similar to that used for bamboo paper and will be described under that heading. The reduction process, although similar to that used for bamboo paper, is simpler and takes less time.

The straw is bundled and soaked in a pit of water for a month. It is then removed, washed thoroughly and stacked in layers in a dry pit, each layer being sprinkled with slaked lime containing 1 per cent soda. After removing the excess water and lime, the fiber is steamed and made up into a thin pulp with mucilage. The paper is made on a hand frame, after which it is pressed and dried, generally on the kiln drier described later.

This coarse, dark brown paper is familiar to the American boy as the inner tube of the Chinese firecracker. It is the wrapping paper for all foodstuffs, doing the work of our old butcher paper. Large quantities are punched full of holes to represent the Chinese cash—brass money with square holes—and burned at funeral ceremonies to provide the spirit with money to pay the ferryman across the River Styx. This paper is produced in large quantities, especially on the northern border of the Chengtu plain, where plenty of rice straw and water from the irrigation system are available.

CHU CHIH OR BAMBOO PAPER

This is the most interesting paper to the chemical engineer. The best paper produced in Szechuen is

FIG. 2—STONE GRINDING FLOOR

made from bamboos. Since the process is said to be over ten centuries old, it will be described in detail.

More than thirty varieties of bamboo grow in western China, of which only two are commonly used for paper making. These are *Tzu Chu* or Spiny Bamboo, *Bambusa arundinacea* and *Ch'ung Chu* or Grove Bamboo, *Phyllostaclys heteroclada*. The second is used by most paper makers. This variety grows to a height of 16 to 18 ft. and is 1½ to 2 in. in diameter. It grows to its full height in about 2 months, naked of leaves. When the full height is attained leaves spring out at each joint, which roughly represent each day's growth. Most Chinese paper makers prefer to use the young culms before this leafing-out occurs, for they say the leafing-out process hardens the nodes and makes them difficult to reduce by the usual retting process.

Manufacture of Paper From Young Bamboo

The process used to turn this bamboo into paper varies a little in the different parts of the province. The process as it was observed in the district along the Chengtu-Wanhsien post road will be outlined first; and the differences as given by other observers for other important centers will then be mentioned.

The bamboo is first cut into 8-ft. lengths and then split lengthwise into eight parts. The split cane is laid in pits with alternate layers of lime, about 10,000 catties of bamboo with 1,000 catties of lime making up a charge. The matted bamboo is weighted down with stones and covered with water, in which condition it is permitted to stand for 2 months. The bamboo is then removed, washed and soaked for 2 months in clean water to leach out the lime. The water is drawn off and the mass permitted to ret in this moist condition for 2 months, after which it is hammered to a pulp in a mortar or stone mill and finally is rubbed to a fine pulp in a stone trough by stamping under foot. This pulp is mixed with cold water and mucilage in stone vats, after which it is dipped out on hand frames which are stacked in a press and pressed semi-dry. The sheets are dipped singly into rice water and are then dried on the side of a hot kiln.

Hosie and Wilson describing the same process state that the first reduction of the fiber is done in the vats with wooden rakes. They also state that 1 to 3 per cent of soda is added to the slaked lime in the retting process. It is known that caustic soda is sent to the Chung Chow and Mien Chu districts for paper making by importing firms. This use may account for the fact that the paper from these districts is whiter and better than that from the other districts. Probably a much larger amount of caustic would be used if the $200 a ton freight charge and the extra importing commissions did not make the price almost prohibitive.

Apparatus Used

Concrete Vats.—A deep hole 12x6x5 ft. deep is dug in the ground and lined with Chinese cement—lime, mud and crushed brick. In these pits, one of which is shown in Fig. 1, all the treatment with lime to release the fiber is carried out.

Pulp Reducers.—The well-retted bamboo is first reduced in either a giant mortar and pestle by man-power or more usually by cow-power on a stone grinding floor. Such a floor is seen in Fig. 2. A grooved limestone roller is hauled around the post counter-clockwise, breaking up the bamboo on the floor. To clear the floor, the direction of rotation is reversed. The pulp is moist in this operation. The pulp thus prepared is broken up finer by being trodden under the feet of men in an inclined ribbed stone trough, such as is shown in sketch of Fig. 3.

Mixing Vats.—The well-trodden pulp is mixed up with mucilage from the Hibiscus plant in stone tanks 80x30x30 in. deep. These are made from red sandstone slabs 2 in. thick, made watertight by use of chinawood oil putty—i.e., whiting plus the oil.

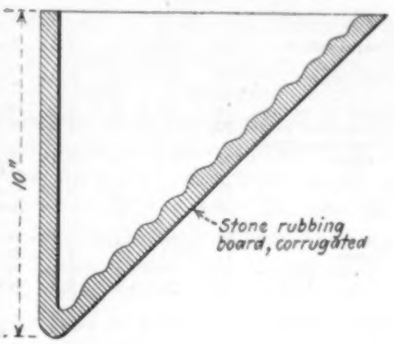

FIG. 3—CROSS-SECTION OF STONE RUBBING TROUGH

Paper-Making Frames.—The paper-making frames are a stout framework of bamboo slats with end handles. A split bamboo netting woven in a fine mesh lays over the slats. The longest papers are about 60 in. long and 23 in. wide, so these nettings are a clever piece of bamboo workmanship. An edge clamp extending the length of the frame keeps the netting from floating. In use the frame with the netting is dipped down endwise and sidewise into the well-stirred pulp and gently lifted in a line parallel to the surface, so that a uniform layer is produced. The clamp is lifted, the sheet permitted to drain and the netting turned upside down on the pile of sheets already made, thus causing the new sheet to stick to the pile so that the netting comes loose. The sheets are piled in the bed of the press.

Presses.—When a pile of paper sheets about a foot high is collected in the press bed a board is placed on top, blocks are inserted and the power applied. This is done by means of a capstan and bars. Fig. 4 shows a complete outfit of tank, frame and press. The press is to be seen through the slats of the frame from which the netting is removed. A spring came out of the hill in the rear of the tank so that water was available. Practically all the paper work observed was done in open sheds like the one shown, a thatched roof being the only protection from sun and rain. The mild climate permits this economy.

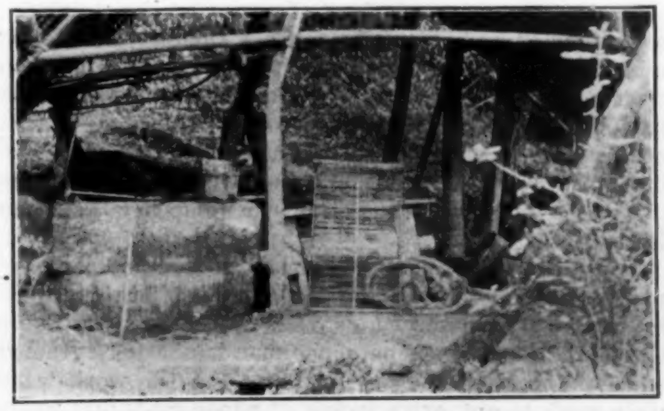

FIG. 4—STONE TROUGH, WOODEN FRAME AND CAPSTAN OF PRESS (SEEN THROUGH SLATS OF FRAME)

Name of Paper		Size Sheet Inches		Cost Per Sheet		
Chinese	English Translation	Length	Width	Chinese Cash	U. S. Cents	Uses
Hsu Peh Chien	White	60.5	12	25	1.0	Writing and printing books.
Go Hsae Chan	Various color	23	14.5	2.5	0.1	Models of houses and servants to use at funerals.
Hwang To Lian	Coarse yellow	16	12.2	1	0.04	Burned sacrifices to gods.
Peh Tu Lian	Pale white	17	12.2	1	0.04	Cleaning surface of tea.
Gong Chuan	Best kind white	24.1	10.1	2.5	0.1	Writing letters.
Gin Chuan	Second best white	20	8.5	1	0.04	Writing letters.
Chin Chang-Chia Chiang	Chia Chiang made white	33	19	4	0.16	Beginning students' writing.
Er Lian	Double	23	15	2.5	0.10	Good printing.
Lao Lian	Old	23.4	17	2	0.08	Account books, printing.
Chang Lian	Long	24.5	16	2.5	0.10	Wrappings.
Dreh Fang	Square	37	19	5	0.20	Window panes.
Hug Lian	Changed white	39	19.5	4	0.16	Wrappings.
Hwang Gin Chi	Golden yellow	38	20	8	0.32	Writing characters to gods to stave off calamity.
Hwang Gin Chi	Golden yellow	45	21.5	12	0.48	
Fang Chi	Square	25	20.5	6	0.24	Window panes.
Chan Lian	Packing	48	23	8	0.32	Writing large characters for invitations to birth and wedding fêtes.
Yang Hong	Foreign red dye	43	20	8	0.32	
Ya Tiao	Good red	45	22.5	16	0.64	Window panes.
Wu Sai Gong Chuan	Five colors good	34	10	4	0.16	Wrappings for presents.

Drying Kilns.—Fig. 5 is a cross-section of the kilns, which are nothing more than plastered flues. Some are 24 ft. long. The pressed, moist paper is spread out on the plastered sides of the kiln and permitted to dry. When a workman has plastered up the whole side with sheets, the first sheet is about dry and peels off, so he can start right over the side again, removing dry paper and putting on wet sheets. These simple kilns are wonderfully efficient and cheap. Straw is the usual fuel.

Sizes of Paper Made.—In an investigation made to see if a modern paper mill was an economic proposition in Szechuen, samples of the most used papers were collected. Since these give a good idea of the skill reached by the native paper maker, the data are reproduced in the accompanying table. The original sheets were sent to a well-known industrial laboratory which was co-operating in the survey. It is interesting to note some of the unusual uses to which the paper is put, such as window panes—a very large use, as there is little glass is used in Szechuen—and funeral ceremonies.

Economics of the Industry

The centers of production of paper in the province are Mien Chu, Chung Chow, Chia Chiang, Lu Chow and the Ta Chu districts. Each is famous for a particular kind of paper. Mien Chu makes the best fine-texture bamboo paper, while most of the straw paper comes from Lu Chow. All the industry is in the hands of small proprietors. It is somewhat seasonal, as the old pulp is just about used up when the new bamboo is ready for cutting.

Four men were required to make a stack of bamboo paper 48x13x30 in. in the Ta Chu district in order to earn 640 cash or 21 cents for the four per day. One man prepared the pulp, one man handled the frame and two operated the drying kiln. All the work was piece work so any extra inches of paper made was paid for at proportional rates. All material and apparatus were furnished by the owners of the plant.

Some of the paper is dyed through, some only on one side, both native and aniline dyes being used. Glossy paper for visiting cards and note paper is glazed by rubbing white insect wax on to the surface with a smooth hard stone.

Modernization of the Industry

We know of only one attempt to erect a modern type of paper mill in Szechuen. This mill was to supply drawing paper for the modern education movement that started about 15 years ago. When the writer first saw the mill it had been closed down for over 2 years. An investigation was made to see if a real plant could be grafted upon the ruins. The reasons for the failure of the mill are such as frequently beset Oriental enterprises and are as follows:

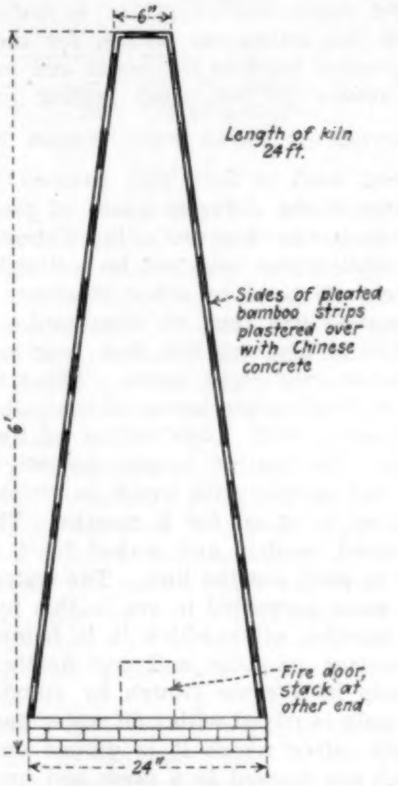

FIG. 5—CROSS-SECTION OF PAPER DRYING KILN

1. Plant was wrongly located, since the raw material for the kind of paper wanted had to be imported from Japan. This meant that for every pound of paper produced 2 to 3 lb. of raw material had to pay a freight rate of $200 per ton. Thus Japanese paper, in spite of cheaper Szechuenese labor, could sell for less than the local product.

2. The local market for the paper produced was not of sufficient size to run the plant at a reasonable percentage of capacity, so the paper produced had a very high overhead charge. There was no export market, as will be seen from reason No. 1.

3. Officials who had supplied part of the funds to finance the undertaking demanded dividends from the day of investment. It takes 18 to 24 months to get machinery from abroad to the interior of China and have it set up and in working order, so this requirement was a severe drain on the liquid funds of the enterprise.

The estimate of the value of the existing plant as the basis of a new enterprise was not sufficiently attractive

to interest the new investors, so the plant was permitted to settle back into the discard.

Since the native plants have seen the advantage of caustic soda a good demand has sprung up for this material. British merchants supply most of the demand. There is a good chance for an electrolytic caustic-bleach plant in the paper regions if the central government could be influenced to forego the present prohibitory tax on the necessary salt. Hydro-electric power could be developed in most of the paper sections very cheaply.

The present craze for newspaper publishing in China has given rise to a demand for paper of better quality than the best bamboo paper. At present all this paper comes from abroad, making a 10,000-mile trip to the interior and paying the large freight rate spoken of before. The risk of spoilage that accompanies so many rehandlings and water transport in the rapids of the Yangstze River adds considerable to the expense. Considerable research will be needed to get a paper of sufficient strength for printing presses of modern type, but experience in India has demonstrated that bamboo paper of high quality can be made with a competent technical organization. Bamboo grows so quickly that an abundant supply of raw material is always at hand, so that a fairly large modern paper mill could be run in this part of the world and be assured an abundant supply of raw material and a ready market for its product.

Legal Notes

By Wellington Gustin

Refining Company Responsible for Escaping Oil Causing Damage to Overflowed Lands

In an action brought against the Midwest Refining Co. the Sussex Land & Live Stock Co. charged that it was committing a nuisance in permitting oil from wells in the Salt Creek oil field operated by it to find its way into Salt Creek, and upon occasion of floods in that creek to overflow with the water upon plaintiff's pasture lands, damaging the pastures. Plaintiff sought to enjoin the refining company from permitting the escape of the oil in the manner indicated and asked damages of approximately $222,140.

The Refining company denied the escape of any substantial quantity of oil upon plaintiff's land, and denied there was any damage in consequence of the escape of any such oil; that the damage, if any, was caused by the natural escape of oil not within its control. It further contended that the damage, if any, was largely contributed to by other practices, and that the oil field, so far as the defendant was concerned, was operated through modern, scientific and best-known methods which would in law relieve the defendant of any damage on account of the escape of oil. And further it argued that if damage were caused through the operation of the oil field by itself in the manner indicated, in any event an injunction should not issue, on account of the public welfare, including the vast amount of money involved, the great number of employees engaged in the enterprise and the life and prosperity of entire communities being largely dependent upon the continued operation of the field.

The District Court for Wyoming, after hearing testimony covering 3 weeks, entered a decree providing that if within 60 days the Refining company pay plaintiff damages assessed in the sum of $2,880 with costs of the suit, and further pay the sum of $720, the annual rental of the lands, yearly the injunction would not issue, but otherwise the injunction to issue restraining the Refining company from the commission of the trespass upon the lands.

Rental Value of the Land Is Measure of Damages

Further the court says that in such cases where damages result from oil escaping into a stream and carried over lands upon the overflow of the stream, the measure of damages may be based upon the usable value of the lands as measured by loss of profits, or upon the rental value of the land. Here the proper measure of damages was the rental value of the land.

The court further says that the damage to a going business by another either on account of negligence or the commission of a continuing trespass may be the loss of prospective profits, providing they are proved with reasonable certainty so as to take them out of the realm of speculation, uncertainty and remoteness. In this case there was insufficient evidence to show plaintiff's profits before the damage as compared with his profits after the damage, and therefore the court held this would not justify an award for loss of prospective profits. Accordingly the rental value of the land was all plaintiff was able to recover from the Refining company.

Damages for Refusal to Accept Goods

The damages for refusal to accept goods are the difference between the market price and the contract price at the time and place of delivery, says the Appellate Term of the New York Supreme Court in an action brought by Robert W. Bonynge against the Carex Company, Incorporated, 188 N. Y. S. 750.

It appears that the Carex Company bought of plaintiff 50 barrels of acid in March, which product was duly tendered in June to the company, which refused to accept delivery, but requested the sellers to hold said goods for its account, agreeing to pay the storage and insurance charged. But between July 29 and Nov. 1 of the same year, the sellers sold the acid at the best prices obtainable, the result being a difference of some $1,093, for which they brought this suit, together with certain storage charges.

Price Difference on Delivery Date Basis for Fixing Damage

It was not denied that the seller was entitled to a judgment for failure of buyer to receive and pay for the acid, but the buyer contended the measure of damages should be the difference in the contract price and the market price on June 1, when the acid was tendered for delivery. The seller contended that the buyer's request that the goods be held by the seller for its account amounted to a "waiver" of its right to object to complainant's failure to resell on that day. However, it was not shown that the seller agreed to such extension of time, nor was there set out any definite time for the extension to agree to. Having not shown any agreement for an extension of time to the buyer to receive and accept the acid, the court held that there could be no recovery for the difference betwen the contract price and proceeds of resale at a later date because of the buyer's request for extension of time.

The Technology of the Carbon-Electrode Industry—IV
Grinding, Mixing, Molding and Extrusion

These Important Steps in Production as Carried Out in Modern Electrode Plants Receive Critical Attention, With Special Reference to Effects Produced by Various Types of Equipment — Other Factors Affecting the Quality of the Finished Carbons—Inspection and Grading*

BY CHARLES L. MANTELL
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IN PRIOR articles of this series the discussion has been carried through the selection and calcination of the carbonaceous materials used in the manufacture of carbon electrodes. The next step in the production process is that of grinding. The calcined materials (coal, coke and petroleum coke) are delivered from the calciners in sizes varying from fines to the largest pieces that will pass through a 3-in. screen.

To obtain the greatest density and highest tensile strength in the finished electrode, it is necessary for the pulverized material to be graded properly—that is, to be composed of a mixture of large and smaller particles in a definite proportion rather than entirely of uniformly sized particles. The theory is that the smaller particles fill in the interstices between the larger ones and thus reduce the porosity of the mass and also increase its density. It can easily be shown that the porosity is the same in a mass of round particles of the same size, regardless of their dimensions.

Reasons for Pulverizing

Pulverizing is done with either of two ends in view: (1) To obtain the desired or as near as possible the desired grading by grinding all of the material in a mill which has been arranged to give the specific grading, or (2) To obtain the desired grading by screening the differently sized components of the pulverized material into various divisions and later building up a second mixture of the proportions desired.

Both of these methods are used, the latter principally in Europe and not at all in the United States. The second method tends to become complicated, as there is likely to be, at some time or other, an excess of some division of the pulverized material after screening. The second method involves a number of tanks for the screened material, a number of weighings and proportionings of the separate divisions of the screened material and a remixing to cause the large and small particles to be uniformly distributed throughout the mass.

Inasmuch as most electrodes are made of at least two carbonaceous materials, it is not necessary to go to the trouble of separating the various sizes of pulverized materials. Grading of the particles may be accomplished by pulverizing one material finer than the other, and mixing them in the proportions desired.

The unit most largely used in American practice for pulverizing the calcined material is the roller pulverizer with air separation. This machine requires a feed of material of approximately 1-in. size for efficiency operation at maximum capacity. It is usual, therefore, to pass the calcined material through a roll crusher in order to break it down from 3- to 1-in. pieces, preparatory to sending it through the pulverizing mill. These crushers are corrugated rolls, equipped with reciprocating plate feeders.

Butts, the unconsumed portions of used electrodes, constitute a large portion of the raw material of electrode plants supplying certain industries, such for instance as the reduction of aluminum. Butts are generally hard, tough and somewhat brittle. Their pulverization for re-use presents a more difficult problem than grinding petroleum coke. Former practice was to crush them first in a rotary crusher and then feed them to a ring pulverizer or a roller mill. Under present practice greater capacity per machine is obtained by first cracking and crushing the butts in a jaw crusher, then after picking out metals and other contamination they are run into a rotary crusher and finally are fed to a roller mill.

Pitch Grinding and Storing

Practice as to grinding pitch differs in the various plants according to the mixing requirements. Some plants obtain satisfactory results by merely coarse-grinding the pitch in a rotary or a gyratory mill after the material (as it comes from the still) has been broken up in a corrugated roll crusher. This method gives a ground product varying in size from fines to pieces passing through a 2-in. ring.

The second method is to fine-grind the crushed pitch in a mill of the swing hammer type. This yields a product all of which is smaller than ½ in.

The storage of great quantities of finely ground pitch is a difficult problem. If large masses are left undisturbed for several weeks, it will be found that the lower portions of the pile have regilated, or run together, much like ice when it freezes. The pile can be broken up only by pickaxes, air drills or blasting. For this reason it is common practice in electrode plants using finely ground pitch to grind only a single day's supply in advance.

Pitch dust, according to tests in the explosion gallery of the Bureau of Mines, is very explosive. This is due to its high percentage of volatile matter. The grinding of calcined petroleum coke and calcined coal, on the other hand, is attended with very little hazard, since these materials have had practically all of their volatile matter driven off.

Pulverized materials are usually stored in large inclosed steel tanks, elevated from the floor and having outlets at the bottom. Material of this fineness flows

*Part I of this series of articles reviewed the history of the electrode industry and appeared in *Chem. & Met. Eng.*, vol. 27, No. 3, p. 109; Part II, discussing the raw materials, was published in vol. 27, No. 4, p. 161; Part III was concerned with the calcination process and is to be found in vol. 27, No. 5, p. 205.

very readily and accordingly leaks out through every small opening much as if it were a liquid. Two devices which are successfully used to control the flow of pulverized material of this sort are the "blast gates" or "coal cocks" made by the manufacturers of pulverized fuel equipment.

Soft pitch is melted prior to use or else a supply is kept in a melted condition. When tar is employed as a binder, it is usually thinned by heating so that it will flow more easily and can be more readily measured. Summer oil, another constituent of the mix, is usually stored in large tanks, from which it is piped to the mixer room.

Mixing Practice

Proportioning of materials is usually done by weight in the case of solid substances, and by volume in the case of liquids. The solid materials are drawn from their various tanks and weighed into the mix box in the proportions desired. Experience with table proportioning machines has been generally unsuccessful because the dust is so lively that it would flow over the tables of the machine and would not assume a position of rest which is necessary for the operation of the machine. The dial type scale has been successfully used for weighing dusts. In operating this, a workman permits dust from one tank to run into the mix box until the required weight is obtained, and then closes the valve on one pipe and opens it for the supply of the next constituent, thus making the operation continuous until the mix is obtained. No matter how clever the workman was, some poorly proportioned mixes would slip through.

An improvement in proportioning mixes has come with the installation of automatic weighing machines. Separate scales are used for each material, each scale dropping its charge into a common hopper which empties into a mix box. They operate on the balanced beam principle, discharge through toggle mechanisms when they have weighed their charge, and after discharging, return to position for another weighing. They can be set for any number of successive weighings without interruption.

The weighed dust, along with the binder if it be hard pitch, is dumped from the mix box into the mixing machine. If the binder has not yet been added, it is poured or run in some time during the mixing. Mixes with pitch as a binder are not stored for any great length of time after being proportioned, as segregation may take place and make it difficult to produce an even and uniform mix.

The mixing machines are heated by steam jackets and have some sort of provision for loading and dumping of the charge. One type, which is perhaps the most used, consists essentially of a steam-heated drum mounted on its side. Mixing is accomplished by rotating a central shaft with arms attached to it. The forward tilt of the arms, which during rotation carry the mix forward, finally discharges it through the door at the end of the drum.

The object desired in mixing carbon is to use as little binder as possible and still have the material extrude from the die and not crush or fall to pieces. The condition which is desired in making a carbon mix is to cover each particle of dust with as thin a film of binder as possible, so that when the various particles come in contact they will be well bonded together. Theoretically it is possible to calculate the minimum amount of pitch necessary to accomplish this purpose and several attempts in this direction have been made by the National Carbon Co. The practical difficulties met with in carrying out experiments of this type are practically insurmountable, due to the inability to obtain the size of all the particles. Fortunately, however, an experienced mixing and pressroom foreman who has had the proper training, can gage the amount of binder in the mix he is using so closely that if ½ lb. of binder per 100 lb. of mix is removed from the mix, it will cause the product to come from the extrusion press badly cracked.

Pan rolls are used both in this country and abroad for the purpose of obtaining a more uniform and denser mix than that given by the mixer alone. As far as the writer has been able to ascertain, they are not used for rolling a mix with a hard pitch binder.

Comparison of Molding and Extruding

But to return to the flow of material itself, it is delivered from the mixers to the presses for the shaping of the electrodes. This can be done in two different ways. One is by placing the mixed material in a mold and subjecting it to great pressure. The other is to place the carbon mixture in a cylinder, and by means of hydraulic pressure force the mixture through a die or mouthpiece of the requisite shape. Electrodes made by the first method are termed "molded," and those by the second extruded or "forced." Both the methods produce products that are homogeneous and of low porosity. The molding process usually results in a higher density electrode.

Extruded electrodes are usually used for electrolytic work. The reason for this is that it is easier to make the sizes of electrolytic carbons by extrusion, as only one or a few dies are needed, while many molds would be required to produce the same result by the molding process.

Due to the rapidity of the process, small electrodes are usually made by extrusion. Large electrodes can be made by both methods, those made by molding being preferred because of their higher density. Extrusion presses are now made so that electrodes as large as 36 in. in diameter can be produced by this process.

In the case of large electrothermic electrodes, the high density and low resistivity of the electrode are not as important as when smaller currents are used.

The equipment usually used for molding consists of the dies of the shape of the finished molded article and upright hydraulic presses to compress the materials in the mold. The molds are made of steel, or in some cases of heavy cast-iron construction, for they must stand great pressure.

The mixed material is placed in the mold as compactly as possible with enough extra material as has been determined by practice to compensate for the compression and still have the finished article fill the mold. The mass is pressed to shape between the top and the plunger of the hydraulic press. It is stated that pressures as high as 25,000 lb. to the square inch are sometimes used. Mixes for molding are generally made with pitch binders. The articles are removed from the mold as soon as they are cold enough to hold their shape, excess material is removed and the mold cleaned and lubricated for the next pressing.

Extrusion is a much more rapid process than molding, requires less labor per ton of material produced when the same size is produced in quantity. Since

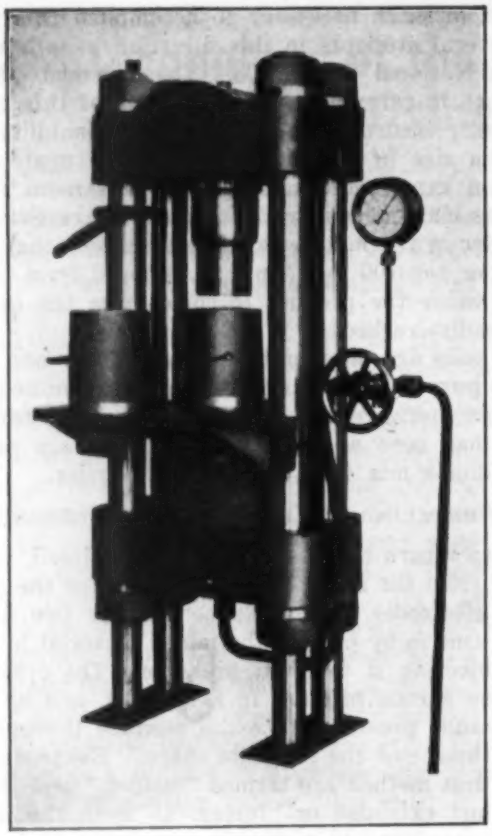


FIG. 12—A 250-TON VERTICAL SLUG PRESS FOR SLUGS 7-IN. IN DIAMETER

most electrodes are made by that process, extrusion will therefore be considered in somewhat greater detail in the paragraphs which follow.

In making electrodes by the extrusion method the hot mix is first "slugged" in the slug presses. These are vertical hydraulic presses, examples of which are shown in Figs. 12 and 13. The hot mix is placed in the mold or "pot," as shown in the illustration, and the material is compressed between the head and plunger of the press. This operation serves only to shape the mix and give it a form in which it can be readily handled. The slug is removed from the pot and is sent forward to be fed to the extrusion press.

Slug presses are normally operated at low pressures —that is, between 800 and 2,000 lb. per sq. in. Often it is necessary to employ some sort of lever arrangement, as is shown in the second illustration, to knock the slug out of the mold. As shown in Fig. 13, this is directly over a hole in working table of the press, through which the slug drops out to the floor or platform beneath. Automatic slug presses, capable of much greater capacity and entailing a much less physical effort on the part of the workmen in slugging the material, are replacing the type of press here illustrated. These are built with revolving tables, the pots being locked in place on the table. Three pots are used, one being filled with the material, another being compressed and a third discharged.

Slugs are made cylindrical in shape, the height being as great as permissible and still allow the slug to be easily handled. Slugging serves to remove occluded air and gas from the carbonaceous mass. The slugs are kept hot and are fed into the "mud" chamber of the extrusion press. This is the steam-jacketed cylindrical section of the extrusion press that serves as a loading chamber. Illustrations of extrusion presses are shown in Fig. 14. This type of press is used for electrodes from 2 to approximately 8 in. in diameter.

Extrusion Pressing

Extrusion or "plug" presses, as they are often called, are operated at hydraulic pressures as low as 1,200 lb. per sq.in., to as high as 7,000 lb., the variation being caused by different plasticities of the carbon mix. Operation is arranged to obtain mixes which extrude at approximately the same pressure. Opinions as to extrusion pressures favoring best results differ somewhat in different plants, but the usual range is between 2,000 and 4,000 lb.

In operation the extruding ram of the press chamber

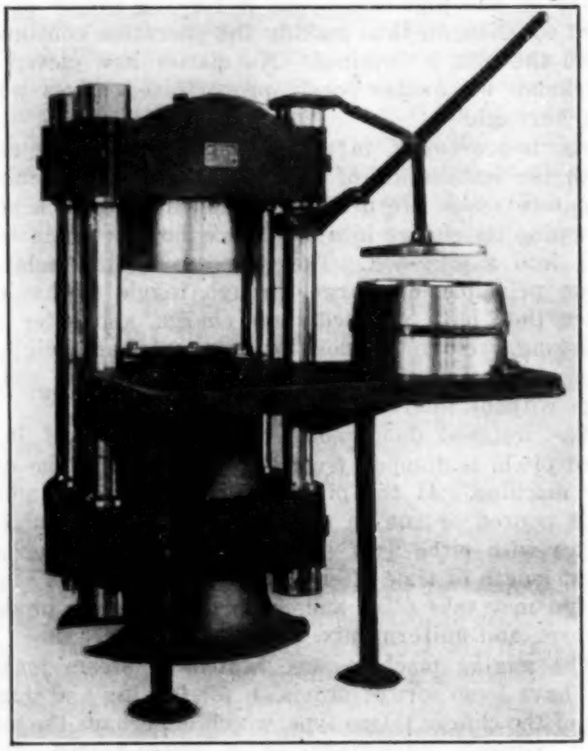


FIG. 13—A 350-TON VERTICAL SLUG PRESS

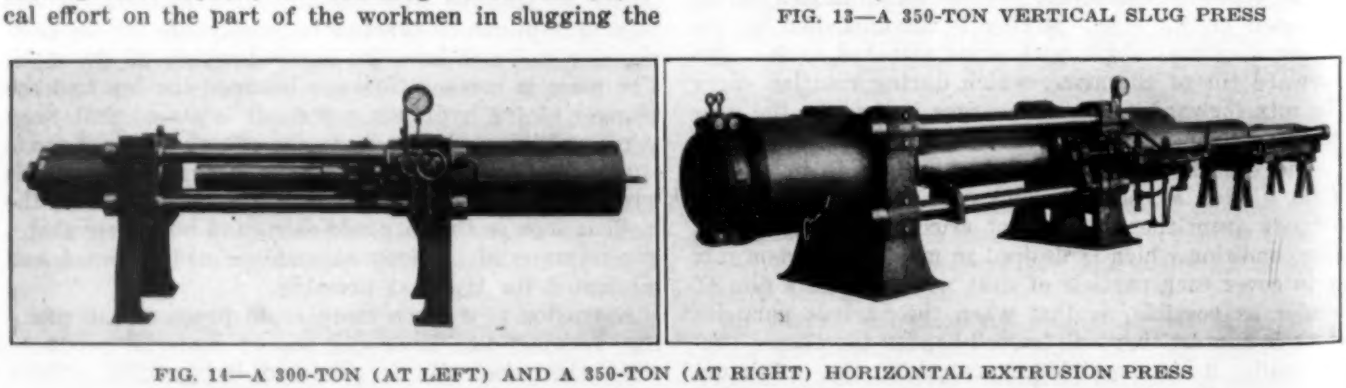


FIG. 14—A 300-TON (AT LEFT) AND A 350-TON (AT RIGHT) HORIZONTAL EXTRUSION PRESS

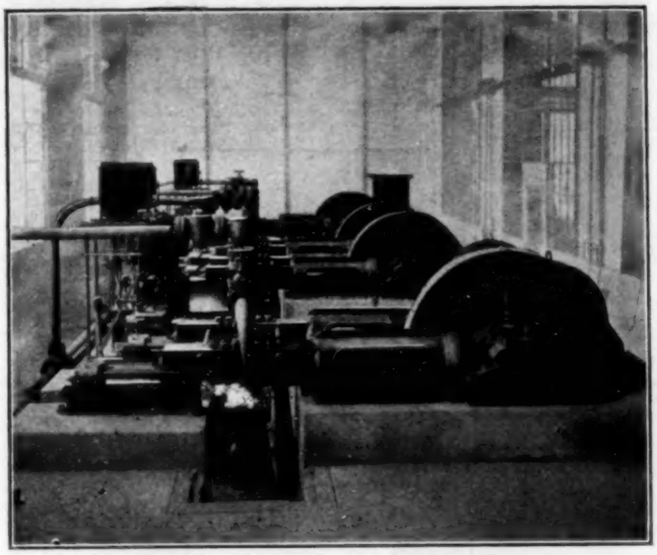


FIG. 15—INSTALLATION OF FOUR 6,000-LB. PRESSURE HYDRAULIC PUMPS FOR ELECTRODE EXTRUSION

is filled with low-pressure water and the ram moves up to and against the carbon slugs in the mud chamber. High-pressure water is then turned into the chamber (being bypassed when not used) and the ram pushes the carbon mass out through the mouthpiece, at the same time pulling the backing ram forward and thus emptying its chamber. When the stroke is finished, low-pressure water is run into the backing chamber, pushing the backing ram out of the chamber. The backing ram pulls the extruding ram back to position, emptying the extruding ram chamber. When the extruding ram is back in position, another load of slugs (usually six), are fed in and the cycle repeated.

The size and shape of the extruded electrode will naturally depend upon the shape of the die or mouthpiece. Tubes can be extruded by the use of a spider setting, placed in the throat of the mouthpiece. The length of the electrode is limited only by the capacity of the loading chamber of the press in terms of the volume of the electrode shape.

The carbons, after being pressed and shaped, are termed "green" to distinguish them from the finished and baked electrode.

Fig. 15 shows an electrode plant installation of four horizontal 60-gal. 6,000-lb. pressure hydraulic pumps supplying power for extrusion.

A Typical Installation

Fig. 16 shows a typical installation for extrusion. An overhead monorail crane carries mixes in a mix box (*B*) to hoppers (*H*) on the third floor, located, one to a machine, directly over the mixing machines (*M*) on the second floor. The dust and binder have previously been proportioned in an adjoining dust storage building. The materials are mixed, and discharged from the machines into a dump car (*C*) traveling on tracks in front of the mixers. The dump car discharges into a hopper (*S*) feeding the pot (*P*) of the slug press (*PP*). The slug press discharges onto a platform (*L*), from which the slugs are conveyed on a roller carrier to the extrusion press loading table (*LL*). The slugs are loaded into the extrusion press (*E*), extruded through the mouthpiece of the press hot, cut to length by a cutting knife mounted on a table next to the die, and dropped into the cooling tank (*C*), which consists of a wood slat conveyor running under water. The green electrodes are discharged from the cooling tank onto an inspection table, inspected, loaded onto weighed truck, and transported to the baking furnaces.

Conditions Affecting Mixing

The mixer and press rooms are the heart of the electrode plant. The quality of the finished carbon is largely dependent upon the quality of the green carbon extruded. A good green carbon will usually produce a good baked one if baking conditions are right. A poor green carbon will never produce a good product no matter how well the baking operations are conducted.

Mixing practice differs even in plants making the same kind of electrodes for the same purpose. Practically all mixing is accomplished by cut-and-try methods and the test as to whether a mix is finished or not is to take up a handful of material and "feel" it. If it "feels" as past experience has shown the mixer man a good mix should, it is finished. It is practically impossible to proportion a mix on paper and have it actually work out in that desired manner.

Most of the difficulties of mixing are due to lack of uniformity of the binder. There is as yet no satisfactory method of determining the binding power of a binding material except actually trying it out. The binding power of pitches varies more or less with their melting points, but differences in the method of manufacture make it possible to have two pitches of nearly the same melting point with widely different binding properties. The thing of greatest importance about pitch and mixing methods is that the pitch be uniform at all times. A good carbon can be made of high-melting pitch; likewise a good carbon can be made of low-melting pitch, but if there occurs, in the course of the day's work, several batches of high- and several batches of low-melting pitch, naturally the carbons themselves will not be uniform in their characteristics unless the mixing and forcing conditions are changed accordingly.

While the melting point has the predominating influence on a mix, the fact that the insoluble residue, which is carbon also, has its effect should not be overlooked. Its effect is not as pronounced as the melting point, for it does not vary so greatly. Obviously a pitch with a

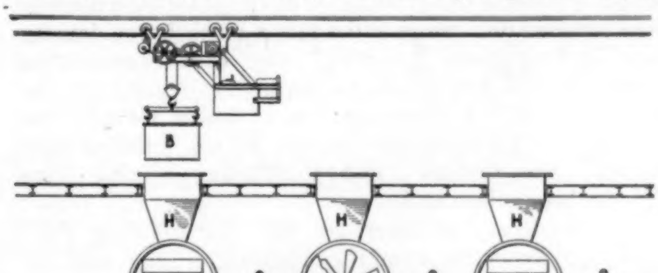


FIG. 16—A TYPICAL INSTALLATION FOR EXTRUSION

high residue will have to be used in greater quantities with a given amount of dust than would be the case with a pitch of low residue, for this residue is finely divided carbon.

Good carbons can be made whether the pitch is finely ground, crushed or melted, but the actual mixing and forcing conditions will vary with each process. Naturally if the pitch is already melted it need not stay in the mixer so long to give a good mix, but there will be some difficulty in adding the pitch so as to keep it from coagulating or agglomerating when it touches the dust. To prevent this it would be necessary to have the dust at the same or nearly the same temperature as the added pitch. Melted pitch can be added to a cold flour and a good mix obtained, although the chances are it would take a higher mixer temperature and a longer mixing time.

A good mix can be obtained by finely grinding the pitch and adding it to the mixer either with the flour or after the flour has been put into the mixer and become heated. A good mix can be obtained by using a pitch crushed in a gyratory crusher, as is the practice at some of the Niagara Falls plants, but here again the same mixing conditions must not be used as with pitch which is melted or more finely ground.

Factors in Green Electrode Production

Table IV shows the most important factors in green carbon production by the extrusion method. Volatile matter (1) has been discussed under calcination, moisture (2) just previously, fineness (3) and grading (4) under grinding, and chemical analysis (5) under raw materials. The effect of uniformity of melting point (6) has just been explained. The term long range of viscosity (7) refers to the amount of change per temperature deg. C. of the viscosity of a pitch. Viscosity is more or less a measure of binding power; for a pitch to have a small change of viscosity per degree means that its binding powers are practically the same over a wide temperature range. Such a pitch would be more desirable than a narrow range viscosity—one whose binding powers change rapidly with temperature. A pitch with a high coking value (8) is preferred, as less of it would distill off in baking and be lost. The grinding (9) of pitch, minimum amount of binder (10) and the grading of dusts (11) have already been touched on. Since pitch has a much lower density than carbonaceous materials, any excess over that needed in the mix tends to lower the density of the green carbon. A green carbon of lower density has its effect in lowering the density of the finished electrodes. The factors (12-14) affecting mixing have already been discussed.

It is necessary to carry out the slug pressing (15) more rapidly with a mix containing a high-melting pitch than with a low one, since the higher melting mix does not remain soft and workable as long as the low. The apparent density (i.e., weight divided by apparent volume) of the green electrode will be largely affected by the pressure (16) employed in slugging. Naturally, within limits, the higher the pressure the greater will be the density. The apparent density of the extruded carbon is usually only two or three points above that of the slug. Uniformity of temperatures (17) is important, as slugs made at different temperatures will have different plasticities and different extrusion pressure. In the plug press one slug is likely to push through another. Lack of unformity of slug temperatures is held to be the cause of "core carbons," a defective product which must be scrapped.

TABLE IV—FACTORS AFFECTING PRODUCTION OF GREEN ELECTRODES IN EXTRUSION PROCESS

DUSTS	BINDER (pitch)
1. Volatile matter	6. Uniform melting point.
2. Moisture	7. Long range of viscosity
3. Fineness	8. High coking value
4. Grading	9. Grinding
5. Chemical composition	

PROPORTIONING

10. Minimum amount of binder
11. Grading of dusts

MIXING

12. Temperature of mixer
13. Time of mixing
14. Additional constituents (summer oil, tar, etc.)

SLUGGING

15. Speed of operation
16. Pressure
17. Uniformity of temperatures

EXTRUSION

18. Pressure
19. Temperature of mudchamber
20. Temperature of die
21. Temperature of extruded carbon

CUTTING

22. Ease of cutting

COOLING

23. Temperature of cooling water in tank

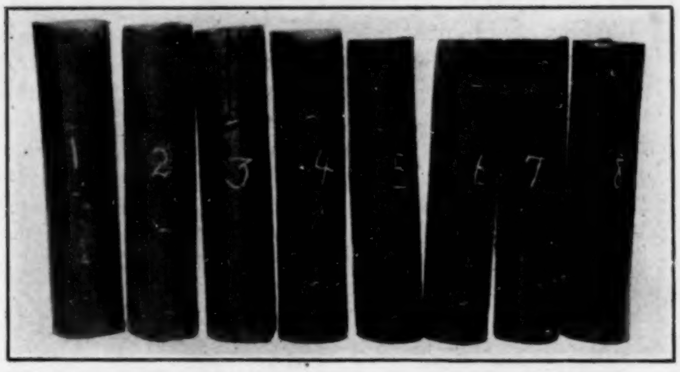
INSPECTION

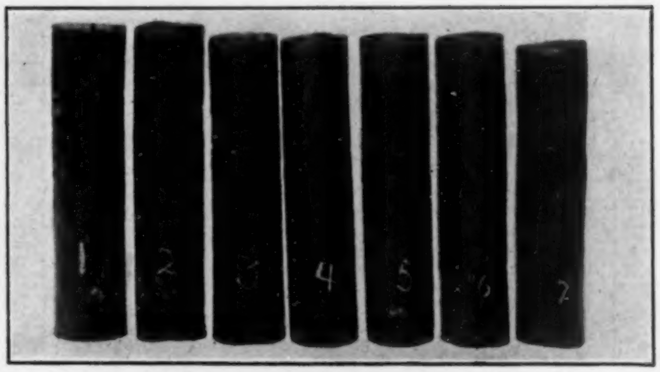
24. Scrap

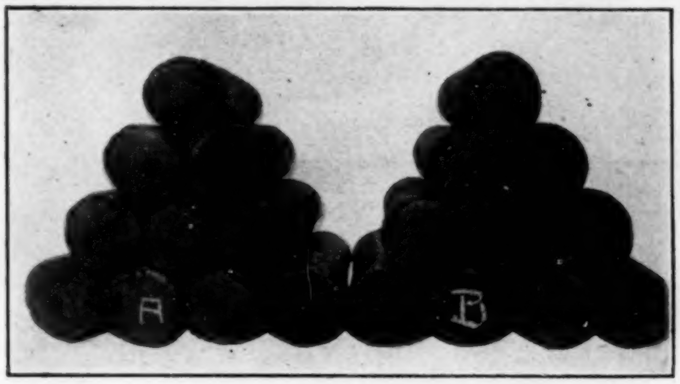
The pressure of extrusion (18) depends upon the plasticity of the material. The addition of summer oil to the mix reduces the extrusion pressure. Excess pitch results in more plastic mixes and lower extrusion pressures. Cold mixes require higher pressures, as their plasticity is less because of the freezing of the pitch. The temperatures of the mud chamber (19) and dies affect both the extrusion pressure and the surface appearance of the extruded carbon. With a colder mud chamber and die the friction between the mix and the walls of the chamber and die becomes greater and additional pressure must be used to overcome this. Summer oil is usually used as a lubricant for the inside of the mud chamber and for the head of the extruding ram. With too hot a mud chamber and die, the carbonaceous mass will be heated, locally probably, and may rise to a high enough temperature to cause some of the binder to distill, evolving gases which break through the outside surface of the green electrode. The temperature of the extruded carbon (21) is affected by the temperature of the original mix, the rate of its cooling and the temperature of the mud chamber and die. It is not desired to have an extruded carbon so hot and plastic that handling destroys its shape. It must be cold enough to retain its form and still hot enough to be extruded.

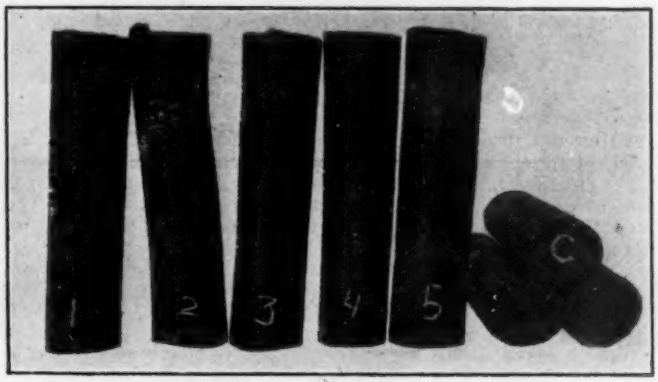
Summer oil in the mix, lessening the binding power of the binder, permits greater ease in cutting (22) than the same mix without summer oil. The closer the mass comes to falling apart at the die the easier it is to cut up the extruded stream into lengths. Excess pitch makes the mass tougher and more difficult to cut.

The temperature of the cooling water in the tank (23) should not be too low, otherwise there is the danger of having the electrodes split. This may be due









FIGS. 17 TO 22—SAMPLES OF DEFECTIVE CARBONS SHOWING CAUSES FOR REJECTION

Fig. 17—Split carbons showing longitudinal cracks.
Fig. 18—End splits (A pile) and core carbons (B pile).
Fig. 19—Pitch carbons (at left) and distorted shapes (1, 2 and 3).
Fig. 20—Die ring carbons.
Fig. 21—Carbons with enlarged (1-5) and oval (C) ends.
Fig. 22—Blistered carbons.

to the contraction of the outside shell (from the sudden freezing of the pitch caused by the abrupt change of temperature) around an internal mass still quite hot. The outside shell may not be strong enough to stand the resistance to compression from the inside and the outer shell splits at the weakest point.

Inspection and Grading

Inspection at the tables at the end of the cooling tanks separates the passable electrodes from those which go to the scrap pile. Good electrodes must be of proper density, have smooth outside surfaces, be free from cross checks or splits, contain no cores, unmelted pitch or foreign material, be cut to proper lengths, be cut square and be well shaped.

The following is a classification of reasons for rejection due to physical defects: (1) Splits. (2) Core carbons. (3) End splits. (4) Distorted in shape. (5) Pitch (in excess). (6) Die rings. (7) Enlarged ends. (8) Oval ends. (9) Blistered skins. (10) Cross checks.

Representative samples of these defects in small round electrodes may be observed from the photographs reproduced in Figs. 17 to 23. The nature of these defects and their causes are discussed in the following paragraphs:

Splits. Splitting of electrodes occurs at the die, at the cutting table and in the cooling tanks. The size of the fissures may vary from a length just perceptible to the eye to the full length of the carbon. The width of the fissure may vary from a very slight crack (as shown in carbons 2 and 6 of Fig. 17 between the chalk marks on the carbon) to easily noticeable defects (as carbons 3 and 8). All, however, are equally undesirable.

Cores. In extreme cases of "coring," the inner cylinder may be separated from the outer shell. If core carbons such as are shown in the "B" pile in Fig. 18 are baked, the inner cylinder may be easily pulled out of the outer shell. The lines of division between the shell and cylinder may be arcs or complete circles. Sometimes an indication of coring may be found at only one end of a carbon.

End Splits. Fig. 18 "A" needs little description. The defect varies in size from a hair line to a quarter of an inch in extreme cases.

Pitch Carbons. The six carbons on the left-hand side of Fig. 19, if examined closely, can be seen to contain pieces of unmelted pitch.

Distorted Shapes. The three carbons at the right of Fig. 19 were rejected because of their distorted shapes. Even if satisfactory for some use, it would be difficult to load such distorted carbons into the baking furnaces.

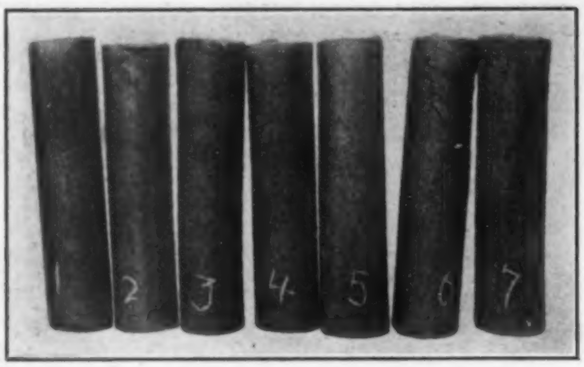


FIG. 23—CROSS CHECKS IN CARBONS

Die Rings. Die ring carbons usually occur at the first carbon of a push. The carbons are scrapped because of possible weakness at the rings and because of difficulties in loading and unloading in the baking furnaces.

Die ring carbons may be roughly divided into two classes. (1) Those produced during a push when for some reason the press was stopped and started. It will be noticed in Fig. 20 that carbons 3, 4 and 5 show a slightly smaller diameter of carbon above the ring than below it. These carbons were produced during a push. The lower portion was the part of the carbon protruding from the press. The protruding portion had expanded slightly. (2) Those produced by an operation analogous to a weld—this is to say, a union made between material left in the press from a previous push and the slugs loaded into the mud chamber for the succeeding push. Examples of these are shown by carbons 1, 2 and 6.

Enlarged Ends. As arranged in Fig. 21 the enlarged ends of the carbons are at the top. It is probable that the enlarged end is of low density and that the ends of the carbon are of unequal density and porosity. These carbons would give difficulty in loading and unloading in the baking furnaces.

Oval Ends. The ends of the carbons shown in Fig. 21 "C" have been mashed by the knife in cutting. Because of their badly shaped ends they would give difficulties in baking as far as loading and unloading in the furnaces is concerned and would give poorer results in use.

Blisters. Blistering may be due to excessive friction between the carbon stream and the die, or else the building up of too high a local temperature under the die when the stream is stopped. The volatile portions of the binder begin to distill and form gas bubbles under the skin of the carbons. As the gases expand, they cause the bubbles to grow larger and finally break. Blistering occurs as the carbons are extruded and released from the pressure of the die. Another theory is that blisters are caused by imprisoned air in the slugs, due to slugs being too tight a fit to press chamber and not permitting air to escape when loading. Blistered carbons are shown in Fig. 22.

Cross Checks. It is not easy to see the defects in carbons 1, 2, 3 and 4 of Fig. 23. The cross check in 1 is near the top of the carbon; in 2, 3 and 4, it is nearer the middle. Cross checks are weak sections. They might be termed lines or planes of breakage. In baking, cleaning or handling these carbons will invariably break at the cross check.

After the electrodes have been inspected and those of the defective types just described have been eliminated, the sound, well-shaped electrodes are piled on trucks, weighed and sent to the baking furnaces. Samples of each lot are taken for density determination and chemical analysis.

Editor's Note. The next article of this series, which will be the baking process and the equipment used therein, will appear in a subsequent issue.

Verifying the Elastic Limit

The French Committee on Standardization authorizes the following method for verifying a supposed elastic limit: "The gaged test-piece is subjected to a quiescent load specified as the elastic limit, and on releasing the load no permanent set must have taken place."

Equipment Used in Petroleum Refining

Chemical equipment manufacturers will be interested in the results of the detailed study of statistical returns made by the petroleum industry in connection with the fourteenth census of manufactures. In the report just issued by the Bureau of the Census a tabular comparison is made of equipment, such as stills, agitators, storage tanks, etc., used in petroleum refining. These statistics are compared with those of the preceding census (1914) in the table which follows:

Kind	1919	1914
Stills, number	6,935	3,639
Capacity (gal.)	174,295,000	(1)
Steam—		
Number	1,061	612
Capacity (gal.)	27,550,000	17,892,000
Fire—		
Number	4,394	3,027
Capacity (gal.)	130,115,000	88,882,000
Pressure—		
Number	1,480	(1)
Capacity (gal.)	16,630,000	(1)
Agitators:		
Number	1,083	770
Capacity (gal.)	52,427,181	(1)
Chilling houses for paraffine:		
Number	105	76
Capacity (gal.)	4,712,000	(1)
Filter houses:		
Number	357	(1)
Capacity (gal.)	11,381,452	(1)
Hydraulic or other presses:		
Number	645	459
Capacity (gal.)	6,258,924	(1)
Storage tanks for:		
Crude petroleum—		
Number	2,183	1,014
Capacity (gal.)	1,511,889,000	580,202,000
Refined products—		
Number	11,380	6,967
Capacity (gal.)	2,152,820,000	1,042,836,000
Fuel oil—		
Number	1,822	807
Capacity (gal.)	1,069,813,000	343,132,000
Other—		
Number	5,546	4,111
Capacity (gal.)	655,346,000	646,608,000

[1] Figures not available.

Z-Transformations in Iron

If a rod of uniform wrought iron be cut into small pieces, each one quenched from a series of successively higher temperatures from 100 to 1,000 deg. C., and its thermal e.m.f. compared against an untreated piece, a curve may be drawn which will not only show the well-known A_1, A_2 and A_3 transformations, but twelve others. The unknown points are called Z-transformations by Prof. G. Borelius of the University of Lund, Sweden (*Annalen der Physik*, vol. 67, p. 227). These irregularities do not occur in pure electrolytic iron fused in vacuo, but reappear and grow in intensity with extended annealings in hydrogen. They may be related to the discontinuous liberation of hydrogen below the critical ranges which are held responsible for the small liberations of heat first observed in thermal analysis of iron by Roberts Austin. Quenching seems to be essential to the Z-effect, and Dr. Borelius concludes they are due to carbon or hydrogen, or other impurities (but not silicon).

Etching of Aluminum Bronze

It is particularly difficult to develop the structure of aluminum bronze (92:8 Cu:Al), especially in the form of rolled and annealed sheet. Rawdon and Lorentz, in Scientific Paper 435 of the Bureau of Standards, note that in a score of comparative etchings the best results by far are had by bubbling oxygen through concentrated ammonia. By this means the boundaries of the crystals are clearly outlined, with a considerable contrast between the different crystals. Cast aluminum bronze will show excellent contrast after 20 seconds in a 10 to 1 mixture of concentrated NH_4OH and 3 per cent H_2O_2 or 5 seconds in concentrated HNO_3.

Black Fractures in Carbon Tool Steels

By Arthur W. F. Green
The John Illingworth Steel Co., Frankford, Philadelphia, Pa.

Occasionally All Bars From a Certain Crucible Steel Ingot Will Show Black Centers When Fractured on Final Inspection — Black Masses Machine Like Cast Iron but Become File Hard on Normal Quenching, Yet Return After Reannealing

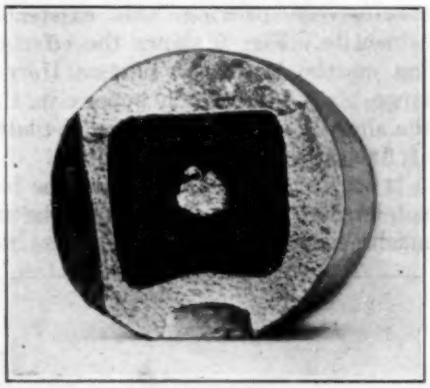


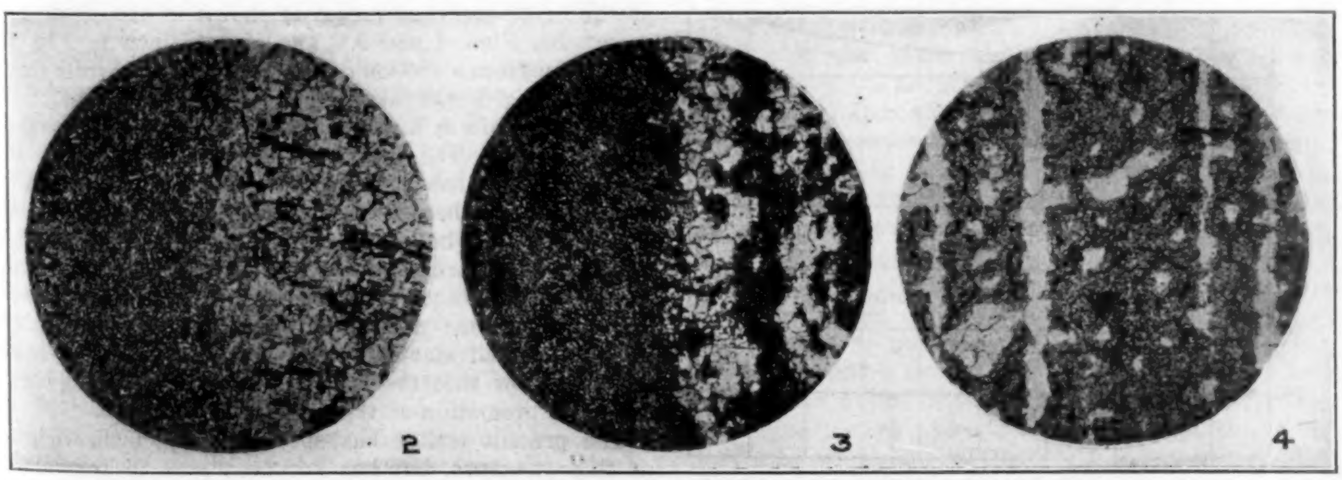
FIG. 1—FRACTURE OF TOOL STEEL WITH BLACK CENTER

It is not an uncommon thing to go into metallurgical laboratories and hear the various "ites" which are found in steel and iron referred to as "animals." Occasionally one hears that a new "animal" has come into being, and then everyone is set to work trying to find whether or not it had been seen before, and if so, what the technical name of it may be, or else they give it a suitable name and otherwise designate it so that it will be immediately recognized when seen again. It is the purpose of this note to show an "animal" which has been seen on a few occasions in this laboratory, but to the best of my knowledge has not been named or otherwise definitely identified.

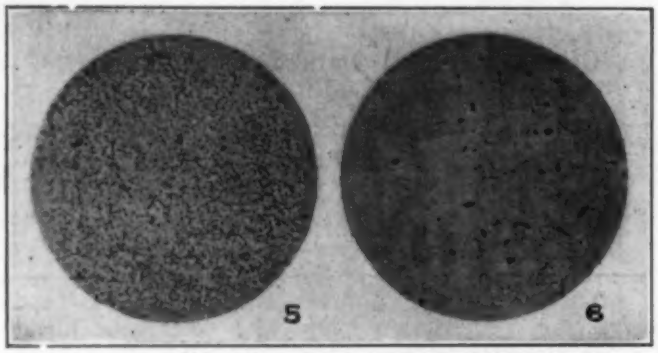
The particular "animal" in question has been noted only in hyper-eutectoid steel made by the crucible process and only in straight carbon tool steel. It is seen by the unaided eye as a mossy, solid black constituent. A definite idea of the material and the well-defined area which it may occupy is seen in Fig. 1. This represents a section taken from a bar of $1\frac{1}{8}$ in. diameter. The same condition existed in the several bars coming from one 100-lb. ingot. None other appeared in several weeks' or months' production. The chemical analysis was in no way unusual or deviated from that aimed at, which was: C 1.16, Mn 0.30, P 0.024, S 0.02 and Si 0.25 per cent. Samples have later been found in which the entire section of the bar has been black in fracture, with the exception of a small area about $\frac{1}{4}$ in. in diameter in the center, and a ring about $\frac{1}{16}$ in. around the outside. Other samples have been found in which only small black areas have been noted, as for instance, in a 2-in. round, in which several well-defined squares were distinguished, one inside of the other, the largest about $\frac{3}{4}$ in. square and the smallest about $\frac{1}{4}$ in. In all cases the blackened areas are symmetrical about the axis of the bar, and conform in shape to the outline of the ingot, billet or bar at same stage in its manufacture.

These black areas have never been noted except in steel after it had been annealed and in which complete spheroidization of the cementite in the unaffected areas had taken place (a structure, it may be remarked in passing, which we consider most desirable for carbon tool steels). On one or two occasions it has been found that the steel was permitted to remain in the reheating furnace at rolling temperatures for a longer time than necessary, so that the square-shaped areas usually noted may be the result of conditions caused by that circumstance. However, it is not until the bars have been annealed, as before stated, that the black areas become noticeable. The temperatures employed for annealing were always about 1,300 to 1,350 deg. F. or just under the $Ac_{1,2,3}$ range, as evidenced by the complete spheroidization of the cementite in the unaffected areas. Annealing is done with careful pyrometric control in large modern furnaces, holding about 7 or 8 tons per charge. Only occasionally will two or three bars from a certain ingot emerge with this defect. It is discovered in the inspection, since each bar is nicked, broken, and the fracture examined before it is sent out on order.

Chemical analyses have been made of both the black portions and the light ones in the same bar, but no differences have been noted in carbon content or otherwise. The sample depicted in Fig. 1 showed 1.16 per cent carbon throughout. When the dark portions are



FIGS. 2 TO 4—MICROSTRUCTURE, ETCHED WITH PICRIC ACID. × 100
FIG. 2—Transverse section at junction. FIG. 3—Longitudinal section at junction. Fig. 4—Longitudinal section in black mass.



FIGS. 5 AND 6—MICROSTRUCTURE ETCHED WITH SODIUM PICRATE. × 100
Fig. 5—Normal structure of steel.
Fig. 6—Longitudinal section in black mass.

machined they give off identically the same kind and color chips as does high-grade gray cast iron. The black areas are also much softer in the annealed steel than are the good ones (Brinell 95 against 170). When the material is ground on an emery wheel, no difference is noted in the sparking between the good areas and the black ones, both giving off the characteristic sparks of a hyper-eutectoid steel of the same analysis.

Microscopic study of the material shows some interesting conditions as seen by referring to the accompanying photomicrographs. Fig. 2 represents a section of the material at the sharp junction between the good and the blackened areas. The cementite is spheroidized in those areas which do not appear black to the unaided eye. You will also note that the other portion which appears black to the unaided eye shows microscopically somewhat as a low-carbon steel. This photomicrograph was made from a transverse section. In Fig. 3 is shown

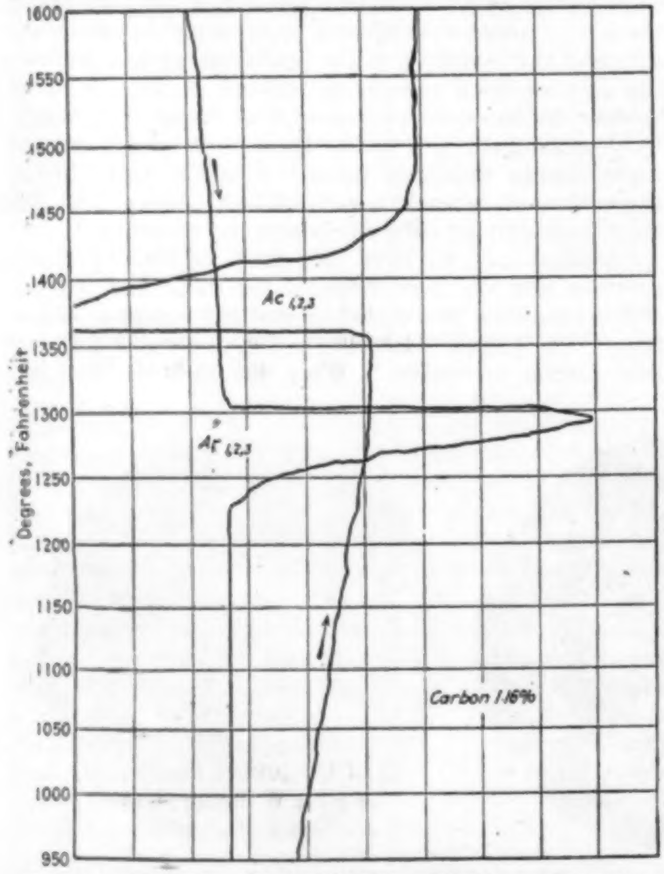
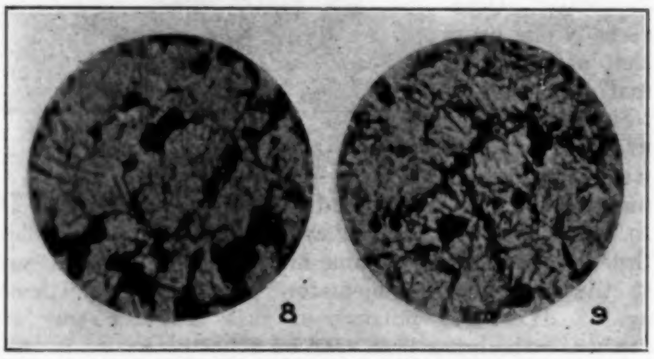


FIG. 7—HEATING AND COOLING CURVE OF SAMPLE CUT FROM BLACK MASS

a portion of the same sample in a position approximate to that shown in Fig. 2, but here the material was cut longitudinally, and the etching is slightly deeper. Fig. 4 shows a lightly etched section of the black area in longitudinal section, and attention is especially called to the free iron areas and the dark network in the etched portions.

Some of the material was etched in boiling sodium picrate solution to ascertain whether any free cementite occurred in the blackened areas. The results of this treatment on the good portions are shown in Fig. 5, conclusively proving the existence of spheroidized cementite. Fig. 6 shows the effects of the same etching on the blackened parts. Here will be noted the large black dots which appear in the free iron and in the slightly darkened areas. The latter may be made up of finely spheroidized cementite.

It was at first believed that the black material would not harden, especially because the manner in which it machined suggested that it was full of graphite. In



FIGS. 8 AND 9—HARDENED STEEL SHOWING MARTENSITE AND TROOSTITE, ETCHED WITH PICRIC ACID. × 500
Fig. 8—Spheroidized cementite after hardening.
Fig. 9—Black mass after hardening.

order to get as much information about the hardening as possible, a sample was carefully machined from the blackened portion of a sample and critical points obtained therefrom. The curves are shown in Fig. 7, and are no different than those of a usual hyper-eutectoid steel of 1.10 to 1.20 per cent carbon. Several pieces were then taken from bars containing some of the blackened material and heated to an indicated furnace temperature of 1,420 deg. F. One was quenched in water, and two were quenched in brine from the indicated temperature. All of the samples were file hard throughout. The microstructure of one of the brine-quenched pieces is shown in the photomicrographs, Figs. 8 and 9. The piece shown in Fig. 8 was taken from a section of the good portion, while that shown in Fig. 9 was taken from the blackened area.

After the pieces had been hardened, two were taken and annealed. The first was heated to 1,400 deg. F. and held for 3 hours, then slow-cooled in the furnace. The second was heated to 1,320 deg. F. for 2 hours and slow-cooled in the furnace. In the first piece the original black areas returned and the good portions showed no difference from the original, but in the second piece it was noted that parts of the originally good areas had started to become black. This would seem to show that the low-temperature annealing furthers the promotion of this blackened material.

The present writer has speculated upon the origin of this structure, but has not been able to formulate a hypothesis which explains all the facts. Therefore

the effort has been made to give the facts about the "animal" exactly as they have been found, hoping that it may excite some criticism and possibly argument. Others may be able to identify and name the black "animal" from these notes, or present a plausible theory on the cause or causes for its existence. We also have a few bar-fragments on hand which are available to metallurgists who wish to study the phenomenon at first hand.

The Utilization of Waste Heat*

GREAT progress has been made in recent years in the development of methods of utilizing heat, especially in the steel and cement industries, and serving a region in which these products are extensively manufactured, the Lehigh Valley section of the A.S.M.E. appropriately devoted a recent meeting held at Bethlehem, Pa., to a consideration of this subject. Three papers were presented: "Waste-Heat Boilers," by H. B. Smith, of the Babcock & Wilcox Co., New York, N. Y.; "Utilization of Waste Heat in the Steel Industry," by A. T. Lewis, of the Bethlehem Steel Co., Bethlehem, Pa.; and "The Utilization of Waste Heat From Rotary Cement Kilns," by Joseph Brobston, vice-president, Dexter Portland Cement Co., Nazareth, Pa.

The Application and Performance of Waste-Heat Boilers

The Babcock and Wilcox Co. has at the present time installed and in operation, in connection with the various types of industrial furnaces, waste-heat boilers of a total capacity of 153,499 rated boiler horsepower, distributed as follows:

Open-hearth furnaces..	102,211	Glass tanks.............	1,716
Cement kilns...........	15,834	Copper-refining furnaces..	1,347
Beehive coke ovens....	11,730	Nickel furnaces..........	922
Zinc furnaces..........	8,740	Lime and dolomite furnaces	848
Heating furnaces (various types)......	4,243	Malleable-iron furnaces..	373
Oil stills...............	3,975	Silicate furnaces........	232
Gas benches...........	1,328		

The flues and valves connecting the furnace and the waste-heat boiler must be of such construction that the air infiltration and radiation may be kept at a minimum. Very little difficulty is found with radiation losses, but the air infiltration in every plant is, without exception, a difficult problem. Of course, it is possible to install a fan and fan turbine of sufficient size and capacity to overcome all of the air infiltration, but if this is done the net steam output of the installation may be reduced to such a point that the return will not warrant the investment.

Draft and the resistance of the gases passing through a boiler are two of the important factors in waste-heat-installation design. The draft loss is a function of two factors—the loss due to frictional resistance and the loss due to the passage of gases over and under the baffles. In order to obtain the greatest net amount of steam from the boiler, the draft required at the entrance to the boiler and the draft loss through the boiler should be so proportioned that when a steam turbine of minimum water rate for this class of machine is used to drive the fan, the exhaust steam from this turbine will not be greater than can be absorbed by the water in heating all the water consumed by the boiler to 210 deg. F. With such an arrangement there is a thermal loss which, when expressed in boiler horsepower, will be approximately 2 per cent of that generated by the boiler.

Failures Due to Lack of Attention

"Because of the war" is an expression much used when citing causes for trouble and sometimes failure, and to this same cause can be attributed in a large measure the failure of some of the users of waste-heat boilers to give proper attention to the upkeep of their installations. This failure has come through the abnormal drive for output which has affected not only the waste-heat-boiler installations but the apparatus of the entire industrial plant as well. Another thing which has contributed to the inadequate attention has been unreliability of the labor obtainable.

Upkeep Costs Low

There is every reason to believe that the upkeep costs of waste-heat installations are very low, for, taking them as a whole, it will be agreed that because of the low-temperature gases which are encountered the tube losses from blisters will be rendered practically negligible, if not impossible. These low-temperature gases also result in a minimum brick deterioration, and in practically all cases the brick replacement cost should also be negligible. The only class of waste-heat work where brickwork upkeep cost need be considered is in the open-hearth field. While there are systems of reversing valves which entirely eliminate the possibility of explosions in open-hearth waste-heat work, the use of such systems is not general, and with the valve reversing systems in common use it is practically impossible to prevent an occasional explosion. These explosions vary in intensity and have under certain conditions been sufficiently severe to blow out the side boiler wall, and in one instance to break off the header doors from the hinges.

Types of Boilers Used in Steel Works

The simplest form of Babcock & Wilcox waste-heat boiler offered is of the single-pass short-tube type, usually 9 to 11 ft. in length and 27 tubes high with a stack located on top of the boiler setting. This type of boiler is particularly applicable to furnaces requiring a low draft for operation and high gas temperatures as the gases leave the furnace. By high gas temperature is meant a temperature considerably in excess of that encountered in open-hearth and cement work, yet below that encountered in coal- and oil-fired furnaces. It does not follow, however, that such a boiler could not be used with temperatures from 2,500 to 3,000 deg. F., for with these temperatures and the very low draft required the boiler would show a high efficiency.

The typical Babcock & Wilcox waste-heat boiler for open-hearth furnace work is an 18-high cross-drum, usually with 16-ft. tubes, the gases being delivered to the fan through the horizontal circulating tubes. The fan, gears and turbine are supported on a platform above the boiler carried on the boiler columns.

The majority of installations with open-hearth furnaces have been in mills already in operation, and oftentimes it has been no little problem to find a space large enough to install a boiler of the proper heating surface. The sectional design of the B. & W. boiler, however, has been of advantage in such cases, for with this it is possible to modify the width, length and sometimes the height to accommodate the local space conditions and thereby provide a sufficient and efficient heating surface.

*Abstracted from *Mechanical Engineering* for August, 1922.

The returns from such installations have been most gratifying. Not only has there been a return in steam sufficient to pay a handsome return on the investment, but in many of the plants there has been an increase of two heats a week from the open-hearth furnaces accompanied by an appreciable reduction in the coal per ton of steel. This reduction follows from a positive draft control.

Figures given during the war indicated a saving due to the installation of waste-heat boilers on open-hearth furnaces of from 25 to 30 cents per ton of steel produced. On the basis of 25 cents a ton, 50-ton heats and fourteen heats a week for 45 weeks, the annual saving would amount to $8,400, while for a 100-ton furnace it would be $16,800. With a 100-ton furnace there would be offered a boiler of 550 hp., which at the period mentioned could be installed complete for approximately $50 per horsepower, or $27,500. On such a basis the installation would pay for itself well within 2 years.

In a representative arrangement such as would be made with a malleable-iron furnace the boiler employed is 24-high, three-pass, with longitudinal drums, the draft apparatus being located on a platform carried on the boiler columns. The unit is equipped with an auxiliary hand-fired furnace, which makes possible steam generation during such times as the malleable-iron furnace may be shut down. It is possible, however, to operate the boiler on both waste gases and gases from the hand-fired furnace, due to the fact that the draft required to operate the malleable furnace is about the same as that which would be required for hand firing.

Installations in Cement Mills

In 1915 a 1,530-hp. Babcock & Wilcox boiler was installed for the Louisville Cement Co., this company being really the pioneer in the use of the modern design of waste-heat boiler in connection with cement kilns. Regarding the operation of this boiler, H. D. Baylor, superintendent of the company, in a paper presented before the American Institute of Chemical Engineers in June, 1917, said:

> Our coal consumption in the boiler room for 1914 averaged 91.7 lb. per barrel of cement. The waste-heat boiler was put into service during May, 1915, with the result that our average coal consumption for 1915 was 57.6 lb. per barrel of cement. During 1916 the boiler was operated practically full time and our average fuel in the boiler room for the year was 40.2 lb. per barrel.
>
> By using the hot clinker to heat the air for combustion and the waste kiln gases to generate steam, our percentage of heat utilized has almost doubled, showing 67.2 per cent fuel efficiency in the combined system of kilns and waste-heat boiler, and this we hope to increase to 70 per cent by reclaiming a part of the heat now lost by radiation from the kiln shell; and it is but another step to reclaim a part of the heat now escaping from the stack of the waste-heat boiler; or in other words, our combustion efficiency will eventually compare very favorably with general boiler-room efficiency.

In one standard arrangement of waste-heat boilers, economizers, fans, collecting and connecting flues for cement-kiln work there is a common flue located transversely to the kilns into which they deliver the gases. On the opposite side of this flue the boilers are located, the gases passing through the short connecting flues. Between the kilns and the collecting flues, as well as between the collecting flue and the boilers, water-cooled dampers are provided. The bottom of the flue is a series of hoppers for depositing and handling the dust precipitated from the gases. These hoppers are provided with a slide valve and chute for discharging the dust to screw conveyors located beneath the main flue. The boilers, economizers and all short connecting flues are also provided with hoppers similarly equipped with slide valves and chutes. The main flue and all connecting flues are made of steel plate lined with insulating material and firebrick.

An arrangement of this kind lends itself to flexibility in that any boiler or kilns may be taken off without interruption of the plant output, since the boilers are so designed, when there are three or more, that one boiler may be taken out of service and the remaining boilers handle all of the gases. When an installation of only two boilers is made it is not practicable, from the standpoint of cost, to have each unit of sufficient size to handle the total weight of gas, should it be necessary to take one unit off the line. A two-unit installation is therefore not as flexible as one with a greater number of boilers, and with one unit down, the remaining unit, while capable of handling more than half the total gas, would probably not handle more than 75 per cent of the total, necessitating the bypassing of the remaining gas to the atmosphere.

The economizer employed is of the counterflow type. The tubes are inclined horizontally, extending transversely to the boiler tubes. The gases pass downward over the heating surface, thereby reducing the tendency of dust to settle and lodge on top of the tubes. The water flows upward, thereby avoiding pockets should any steam be formed in the economizer.

These boilers and economizers are provided with a type of soot blower which, if properly operated and properly cared for, will keep the gas passages entirely free from dust lodging, so that it hardly becomes necessary to shut down a boiler for external cleaning.

The fan location is at the floor line and a steel stack is carried on the fan housing. The stack should be of sufficient height to relieve the fan of labor in discharging the gases. It should also be of sufficient height to guard against the gases entering adjoining buildings as they leave the stack.

Utilization of Waste Heat in the Steel Industry

The operations of the steel industry are such that very large quantities of heat are necessary to perform the desired work. Only a small part is being converted into useful work, which leaves a large per cent of energy in the form of waste heat.

Blast Furnaces

Most steel plants are equipped with blast furnaces, open-hearth furnaces, mills, forge and machine shops, power plants and buildings, and they are usually so grouped that the utilization of heat in any branch can be converted into work of benefit to the other departments.

In blast-furnace work the gas was considered a waste product a short time back, and still in many furnaces this valuable fuel is bled to the atmosphere. Even in many modern blast-furnace plants a great improvement can be accomplished in its better utilization. This gas is primarily used for stoves, blowing and power engines, boilers and miscellaneous heating. With properly designed equipment and proper control the maximum economy should be obtained, and the quantities are so large that such economy would spell great savings.

A blast-furnace heat balance shows that approximately 40 per cent of the heat available in the furnace

TABLE I—APPROXIMATE HEAT BALANCE OF A 500-TON BLAST FURNACE

Total available gas leaving the furnace, cu.ft. per ton iron	128,000
Net heat value of cold gas, B.t.u	95
Coke rate, lb. per ton	1,917
Air displacement per ton at blowing engines, cu.ft	116,000
Air heated at stoves per ton (from 160 deg. F. to 1115 deg. F.) cu.ft	110,000
Stove efficiency, per cent	60.0
Required by stoves, per cent	32.4
Required by blowing engines, per cent (26 per cent thermal efficiency per air hp.)	8.4
Required by power engines, per cent (23 per cent thermal efficiency per kw.)	21.6
Available for boilers, per cent	37.6
	100.0
Cu.ft. gas per lb. net coke	70
Cu.ft. air to stove per lb. coke	66

is used in its own operation. This includes preheating of the air and the losses carried away from the furnace and leaves 60 per cent available for other useful work, such as power units, boilers and miscellaneous heating. To realize the importance of the proper utilization of this waste gas an approximate heat balance of a 500-ton blast furnace is given in Table I.

Open-Hearth Furnaces

The highest temperature that can be obtained from fuel is desired in the refining of steel. For this process a relatively small percentage of the available heat of the fuel is abstracted, which leaves a very high percentage to pass out from the furnace. A small part of this heat leaving the furnace is recovered in the preheating of the incoming air and gas. In a 70-ton open-hearth furnace from 70,000 to 100,000 lb. of gas normally enters the stack per hour at a temperature of from 1,000 to 1,200 deg. F., and this heat should be utilized. The steel mill usually requires a large generation of steam. The utilization of this heat by means of waste-heat boilers is a means of reducing considerably the total steam-generating costs.

The fuel usually employed is producer gas, unless coke-oven or natural gases—of higher calorific value—are available. In order to develop the necessary temperature and also to effect economy of fuel the air for combustion is preheated before entering the furnace. Where the more sluggish producer gas is used, it is also preheated, which enables it to ignite more readily than when cold. When coke-oven or natural gas is used it is introduced into the furnace without preheating because both are high in hydrocarbons which disintegrate at temperatures above 1,000 deg. F. thereby causing great fuel loss. In the average open-hearth furnace it will be well to note that of the heat absorbed and the heat that is available for waste heat development—

18 per cent is abstracted for useful work
3 per cent is lost in the sensible heat of the slag
40 per cent is lost in the sensible heat of the stack gases, and
39 per cent represents other losses such as radiation, etc.

The largest item is the heat lost to the stack, and in many furnaces this amounts to more than 50 per cent. To reduce it the steel plants have resorted to waste-heat boilers by means of which about 50 per cent of the loss can be converted into steam. Furnace gases normally enter the boiler at from 1,000 to 1,200 deg. F. and are reduced to a temperature of from 450 to 550 deg. F. before leaving. A well-designed boiler equipment with necessary flues is an asset in the operation of a furnace, since the draft may be regulated by the fan speed at the will of the furnace operator. Furthermore, the value of this abstracted heat is equivalent to 60 boiler horsepower per ton of steel. This is equivalent to at least 350 boiler horsepower per furnace of about 70 tons capacity and is valued at $3.50 per hour, using anthracite steam coal at $3 per ton as a basis for calculation. It amounts to $2,500 a year per furnace and is the best way of recovering heat energy that would otherwise be lost at certain times in metallurgical processes.

Mill heating furnaces have a lower exit temperature than open-hearth furnaces, and if the proper state of combustion is maintained and the furnace is designed correctly a higher thermal efficiency should result. The exit temperatures of mill furnaces vary from 850 to 2,000 deg. F., and the quantity of heat generated is dependent upon the capacity of the furnace. A waste-heat boiler installation on such furnaces makes an ideal layout and fits in nicely with the steel-mill boiler plant. Table II shows a typical heat balance of an open-hearth furnace including waste-heat boiler.

TABLE II—TYPICAL HEAT BALANCE OF AN OPEN-HEARTH FURNACE INCLUDING WASTE-HEAT BOILER*

	B.t.u. Per Hour	B.t.u. Per Ton Ingots	Per Cent of Heat in Coal	Per Cent of Heat in Fuel Gas	Per Cent of Heat to Furnace
Coal to gas producers	52,500,000	7,000,000	100.0	.....	.....
Producer loss	8,610,000	1,150,000	16.4	.....	.....
Heat delivered to furnace:					
Gas from producers	43,890,000	5,850,000	83.6	100.0	.....
Combustion of C, Si, and Mn in charge	9,370,000	1,250,000	17.8	21.4	.....
Sensible heat of hot metal	3,450,000	460,000	6.6	7.9	.....
Total heat to furnace except regenerated gas and air	56,710,000	7,560,000	108.0	129.3	100.0
Distribution of heat:					
Consumed in furnace and losses	31,450,000	4,192,000	59.9	71.8	55.5
Utilized in boiler	15,510,000	2,068,000	29.5	35.3	27.3
Wasted to stack at 500 deg. F.	9,750,000	1,300,000	18.6	22.2	17.2
Total	56,710,000	7,560,000	108.0	129.3	100.0

*Results based on the following empirical data:

Size of heats, tons	75
Time per heat, hours	10
Hot metal in charge, per cent	64
Ratio of product to charge, per cent	88
Fuel consumption (4,875 lb. per hr. or) lb. per ton	650
Heat value of coal, B.t.u. per lb	10,700
Weight waste gases at boiler, lb. per hour	81,400
CO_2 in waste gases at boiler, per cent	12
Temperature of waste gases at boiler inlet, deg. F	1,200
Temperature of waste gases to stack deg. F	500
Performance of boiler under above conditions, boiler hp	460

Gas Versus Steam Power

Modern steel plants that have blast furnaces are usually equipped with gas-engine installations. Gas engines have shown marked improvement in recent years and are employed on account of the low total cost of operation, which is particularly true in the blowing units. This is caused by their relatively high efficiency when compared to steam units.

It will be well to consider the percentage heat balance of a gas engine and compare it to that of a steam engine as follows:

	Gas Engine	Steam Engine
Effective work	28	11
Friction in engine	5	2
Exhaust gases	36	..
Exhaust steam	..	57
Cooling water and radiation	31	..
Boiler loss	..	30
	100	100

The total gas-engine efficiency can be raised to above 60 per cent, which establishes it as a most economical

thermal unit. The development of waste-heat utilization in gas-engine installations should create a greater demand for this type of prime mover in the future, and it will show up to better advantage as the price of fuels increases. A very high efficiency is readily obtained by installing waste-heat boilers or economizers in the gas-engine exhaust and utilizing the jacket water either for feedwater, heating buildings, or any other scheme that will fit into plant conditions.

Utilization of Waste Heat From Rotary Cement Kilns

In America, portland cement is burned exclusively in what is known as a rotary kiln. This is strictly an American development. It has always been known that it was not an economical method of burning, but as coal was cheap and labor high in America, it was universally adopted immediately after its introduction, whereas in Europe, where coal was dear and labor cheap, the old style upright kiln similar to a limekiln held its own up to within a few years.

While the largest loss of heat in the rotary kiln was in the excessive temperatures of the flue gases, there were two other important heat losses which were at that time attracting attention, one being the heat carried off by the material or resulting clinker, when it was discharged from the kiln; the other being the loss by radiation through the kiln shell.

There was one notably successful attempt made to utilize a part of the heat of the flue gases. In the dry process of cement manufacture it is necessary to dry the raw material before it can be pulverized. Charles Matcham put his stone driers immediately back of his kilns, and passed a portion of his kiln gases through them. This did not affect the operation of his kilns, dried the stone more effectively, saved about 3 to 4 lb. of coal per barrel of cement made and materially reduced the labor charge in connection with the drying. Only a small percentage of the total stack gases were required for this, however, and there were not many of the installations made.

Money Saved From Waste-Heat Utilization

The sporadic efforts made to use the waste heat of rotary kilns prior to the sudden and material increase in the price of coal caused by the war did not amount to more because of the very low price that the industry as a whole paid for its kiln coal. The coal generally used is the slack or screenings from three-quarter gas coal. This was formerly considered a waste product by the coal mines and had to be moved when the three-quarter coal was shipped, which resulted in a price to the cement industry ranging from 20 to 75 cents a ton at the mines. The cost per barrel for burning cement was therefore comparatively low and the efforts of the manufacturers were mainly directed to installing labor-saving machinery and reducing the cost of pulverizing the raw material and clinker.

When the price of coal jumped to $5 per ton at the mines, however, conditions were entirely different, and in 1915 the first modern waste-heat boiler plant in the cement industry was installed at the Catskill plant of the Alpha Portland Cement Co. This installation was a success from the start. The plant operates five kilns, three being 9 ft. in diameter by 120 ft. long and the other two 7 ft. 6 in. in diameter and 120 ft. in length, resulting in an output of about 3,000 bbl. of cement per day. The gases from these kilns are drawn into a main or equalizing flue directly in the rear of the kiln housing or dust chamber, dampers being installed to bypass gases into the kiln stacks, if necessary. Connections leading from the back of this flue conduct the gases to two 750-hp. Edge Moor boilers, of the four-pass type. Two Green fuel economizers, horizontal type, are installed after the boilers.

The forced draft is provided by a fan located directly back of the economizers, driven by a Terry turbine. A steam pressure of 175 to 180 lb. is maintained, and sufficient power is generated to operate the entire plant. The finely pulverized stone carried over from the kiln by the hot gases is blown from the boiler tubes three to four times in each 24 hours, a hand lance using 140 lb. of air being employed for this purpose. The economizer tubes are blown off through plugged openings in the top of the casing several times each week. The clean-out doors at the bottom of each pass are opened once a week and the dust removed. Clean-out doors are also provided in the flues. In this way, if the draft at the stack chamber is not allowed to drop below 0.25 in. (water pressure), no real difficulty is experienced in keeping the installation free from dust. The temperature of the gases is reduced from approximately 1,400 deg. F. at the mouth of the kiln to about 450 deg. when they leave the economizer. The Cochran feedwater heater is heated by the exhaust steam from the pumps and fan turbine.

Coal Savings From Waste-Heat Utilization

The operation of the boilers has not increased the amount of coal used per barrel in the kilns. It is about 95 lb. per barrel. It requires not less than 40 lb. of coal per barrel to generate the power required to operate a cement mill. Deducting this from the 95 lb. being used in the kiln we find that today this company is burning its cement with 55 lb. of coal, which is much closer to the theoretical amount required—that is, 30 lb.—than the cement manufacturers had ever hoped to come, and means that a rotary kiln with a waste-heat boiler attached is as economical in its coal consumption as the old-style upright kiln. Plants almost exactly duplicating the one described were promptly installed at another plant of the Alpha Portland Cement Co. and at the Dexter Portland Cement Co., and plants using B. & W. boilers were installed by the Universal and Louisville cement plants.

By this time all the manufacturers of portland cement were aware of the importance of this development, and the conservation committee of the Portland Cement Association started an extensive investigation of the entire question. The first report, presented in December, 1918, showed eight plants in operation. Today there are twenty-four plants in operation generating with their flue gases from 51 to 140 per cent of the power they require. There are about 120 operating portland cement plants in the United States, so that 20 per cent of the plants are now making use of their stack gases, saving on the average 40 lb. of coal for every barrel made. This means that these companies are actually using about 400,000 tons of coal less per year than they did formerly.

It may be noted that in some cases more steam than is required to operate the entire cement plant is gen-

erated by the waste-heat installation. In other cases only a little over one-half of the amount required is secured.

While this is to a certain extent a question of the efficiency of the boiler installation, it may be due to other causes. The plant that is burning cement with 80 lb. of coal to the barrel will not have the volume of stack gases or temperature that will be found at the plant using over 100 lb. to the barrel, so that naturally not as much steam can be generated. The total amount of coal used per barrel, however, may be lower at the plant using the 80 lb., as it may be possible to generate the additional power required in auxiliary boilers with less than the extra 25 or 30 lb. of coal consumed in the kiln.

But even when two waste-heat plants generate the same amount of steam, there may be a great difference in the percentage of the machinery that can be run with it. Where the amount of steam secured is just sufficient to operate a mill in which the prime movers are well-designed modern turbines, it would probably be only 75 per cent of the steam required to operate another plant which is still being run with old-style inefficient reciprocating engines.

Power Required to Grind a Barrel of Cement

Where the prime movers are identical, there might still be a wide difference in the percentage shown. Recent investigations show that the power required to produce a barrel of cement at plants using different types of grinding machinery varies from about 13 kw.-hr. per barrel to about 19 kw.-hr.

Some progress has also been made in the last three or four years in solving two other problems. The loss through radiation is being materially reduced by putting between the shell and the firebrick lining in the upper part of the kiln, a brick cut from diatomaceous earth. While it has not been possible to determine the exact amount saved in this way, it has been shown conclusively that where waste-heat boilers are being used this installation raises the temperature of the flue gases 150 deg., and where boilers are not installed the insulated kilns require from 5 to 10 lb. per barrel less coal to burn clinker than those not insulated.

This problem is not as yet fully solved, however, as it has been found impossible to use the insulating brick in the hottest section of the kiln, known as the burning zone. Here the fluxing action of the clinker at the high temperature necessarily maintained was such that the firebrick were practically destroyed in from 16 hours to four days. The hot zone can undoubtedly be insulated by using carborundum, but at the present time the cost of doing this would be prohibitive.

Possibility of Reclaiming Heat Carried Off by Clinker

As to the possibility of reclaiming the heat carried off by the clinker, the development of the rotary pressure cooler in the last few years has demonstrated that where the cooler is of sufficient size and proper design to handle the kiln output it is possible to heat the air entering the kiln to a temperature of 800 to 900 deg. F. and to have enough heat left over to dry the coal used for kiln operation. How much this saves is problematical. So far the power required to operate the system has been found to be so great that there appears to be very little actual saving.

Synopsis of Recent Chemical & Metallurgical Literature

Prism Hardness

A prize was awarded in the fall of 1920 to Dr. Bernard P. Haigh of the Royal Naval College, Greenwich, England, by the Institution of Mechanical Engineers for a method of determining the hardness of excessively hard steels. It also appears to be capable of consistent results on metals as soft as annealed copper.

Briefly, the method consists in crossing two finished bars of the material to be tested and pressing them together with a known force, P. The width of the resulting notch or indentation, w, is then measured with a microvernier, whereupon the "Prism Hardness" equals $P \div w^2$. In practice it is handy to use the fragments of an impact test, holding them in place in a jig and pressing them slowly together in a Brinell machine or small testing machine.

Sharp edges are necessary only on the hardest metals. Tooled or rough ground surfaces are sufficiently smooth, except for glass hard specimens. Provided the faces are reasonably plane and the width rather than the depth of indentation is measured, it is not essential that the angle should be exactly 90 deg.

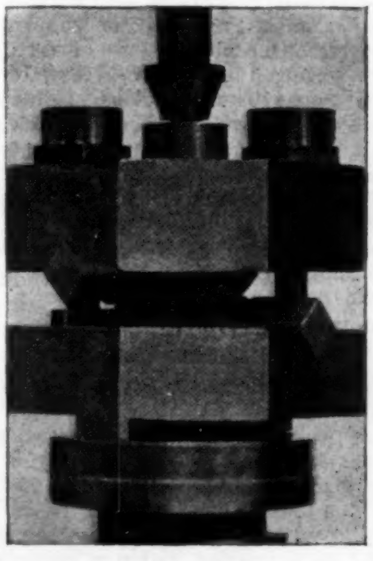


FIG. 1—JIG WITH CROSSED PRISMS IN PLACE

Prism hardness. $P \div w^2$, is remarkably constant with varying loads, as long as the width of indentation is less than half the side of the prism (in soft metals), or no splintering occurs (in hard metals). The tests in the foregoing table on a good 60:39:1 naval brass are illustrative.

Prism Hardness Load (Long Tons)	Prism Hardness Hardness	Brinell Hardness Load Pounds	Brinell Hardness Hardness (10 mm. Ball)
1	36.5	200	63
2	35.8	600	78
3	35.3	1,000	79
4	34.8	2,000	89
5	33.5	3,000	87
..	....	4,000	90.5
..	....	5,000	92
..	....	6,000	93

Results derived from a series of tests on 4 hardened carbon steel knife edges are as follows:

Load in Long Tons	Prism Hardness A	B	C	D
¼	...	...	359	388
½	282	403	357	358
¾	288	...	354	...
1	298	392	359	376
1¼	293	...	345	...
1½	289	382	S	393
1¾	...	...	...	387
2	294	380	...	S
3	287	373	...	...
4	283	378	...	...
5	287	387	...	...

Sample A appears to be incompletely hardened. B is harder than the ball steel usually used in the Brinell test. (Prism hardness 318 tons per sq.in.). Sample C was rejected at the works for brittleness and splintering occurred under loads of 1½ tons or greater. Sample D was rejected for water cracks and splintered at a 2-ton load. "The hardness values do not vary with load more widely than may be attributed to experimental variance or slight changes in structure, and may be regarded as independent of the load applied in making the test."

"The test has proved sensitive to slight differences of hardness, even in the hardest metals."

Loam Molding as an Art

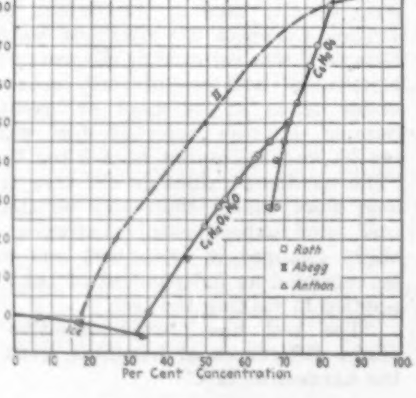
A "History of Loam Molding in the Province of Liége" was presented to the Institution of British Foundrymen at their Birmingham meeting, 1922, by J. Varlet. In a few pages, the author traces the development of the process from the first attempts of a patternmaker named Pirson in 1846, its general adoption by Belgian foundries in 1870, through the period of its greatest perfection (1890-95) to the present practice. Modern methods of molding large cylindrical or conical castings like slag pots or sugar cane colanders and more complex things like flywheels and marine engine cylinders are given in detail.

About 30 years ago a man could not claim to be a loam molder unless he had served his apprenticeship as a core maker, had then studied mechanical drawing and machine design so as to be able to read blue-prints with great facility and understand the function of all common machine units, and finally had served a long second apprenticeship to a leading molder. "He worked with his hands in the foundry and his head at home. Every night he organized his work for the next day. He was animated by a sincere love for his profession; he had the respect of his chiefs; he respected himself, and, above all, he conducted himself as an artisan of an intellectual profession, who had the right to everyone's consideration."

Nothwithstanding the fact that the general appearance and skin of loam castings are much superior to sand castings, the method is not used as much now as formerly, according to the author, because of the disappearance of the long-stroke, low-pressure or slow-speed steam engine.

The Solubility of Dextrose in Water

A recent publication from the Bureau of Standards, No. 437, dated February, 1922, deals with the determination of the solubility of dextrose in water, and of the various solid phases which can exist, including the range during which those phases are stable. The authors, Richard F. Jackson and Clara Gillis Silsbee, have made a really valuable contribution to industrial work with this substance, because the solubilities are of fundamental importance in controlling the processes of manufacture. They found, among other things, that the temperature coefficience of solubility was much higher with the dextrose hydrate, which has a transition point at 50 deg., than it is with the anhydrous dextrose which exists above 50 deg. The existence of the anhydrous form persists in unstable equilibrium even as low as 28 deg. C. The accompanying cut represents the solubility curves as determined at the bureau and as calculated from other literature.



American Fertilizer Production

A paper read by J. B. Lipman, before the Chemical Industry Club, London, on May 24, 1922, and printed in the *Journal of the Society of Chemical Industry*, June 15, vol. 41, p. 233, is entitled, "The Fertilizer Industry in the United States." Dr. Lipman makes a very interesting analysis of the consumption of fertilizer in the United States which, in 1919, was nearly 7,000,000 tons of material. It rose to 7,500,000 tons in 1920, but fell to 5,000,000 tons in 1921, owing to the economic depression. Expectation is that it will increase again at the rate of 5 to 10 per cent a year. It is interesting to note that South Carolina, North Carolina and Georgia use more than 3,000,000 tons and with Virginia, Alabama, Mississippi and Tennessee, these states consume more than two-thirds of the entire fertilizer output. It is used largely for the cotton crop. Naturally, the fertilizer industry depends for its health on the success of the cotton grower. One million tons of fertilizer are consumed in New York, New Jersey and Pennsylvania, and about 800,000 tons in Ohio, Indiana, Illinois, Michigan and Wisconsin. It is to be expected that a marked increase in fertilizer demand will come from the Western states, notably those mentioned last, together with Iowa, Missouri and Kansas, due to the effort to produce more yield per acre.

Raw Materials and Their Distribution

Dr. Lipman then takes up the distribution of raw material and points out that practically all of the phosphate rock now used in the preparation of fertilizer comes from Florida. A half million tons or so come from Tennessee and South Carolina. These supplies may be exhausted within a reasonable time, but there are tremendous deposits of high-grade phosphate rock in Idaho, Utah, Wyoming, and Montana.

Other ingredients, such as dried blood, ground bone, tankage, horns, sulphuric acid, potash, etc., are discussed. In 1918 the large packing houses in Chicago produced about 200,000 tons of high-grade tankage, which is prepared from the refuse from the slaughter house put in specially designed vessels freed from fat and filter-pressed. About 35,000 tons of dried blood and 55,000 tons of bone also originated in packing houses. The production of sulphate of ammonia and sodium nitrate is also discussed extensively and estimates are given of the production and consumption of sulphuric acid and potash.

Dr. Lipman describes two steps in the manufacture of artificial fertilizer. The first has to do with the production of superphosphate, which can be either plain superphosphate or ammoniated superphosphate. This latter is secured by mixing low-grade nitrogenous material, such as leather wastes, hair, etc., with ground phosphate rock and treating the mixture with sulphuric acid. The second step consists of mixing the "base material" with potash and nitrogen in proper proportions.

Many brands on the market are a very low-grade fertilizer—the so-called 1:8:1, or an equivalent of 1 per cent ammonia, 8 per cent phosphoric acid and 1 per cent potash. In the Middle West the proportion is more often 2:8:2, or twelve units of total plant food. Any fertilizer above 14 units in total plant food is called high analysis fertilizer. Some of them go as high as 6 per cent ammonia, 10 per cent phosphoric acid and 7 per cent potash. Due very largely to the tremendous meat-packing establishments in America, nitrogen from animal and vegetable sources has been widely used in fertilizing, although this nitrogen is not nearly as efficient as the nitrogen in nitrate or ammonium salt and in addition, it costs more.

Effect of High Transportation Cost

The problem of transportation of low-grade fertilizers has turned the attention of the fertilizer association to the use of high-grade fertilizers. This tendency will become stronger as the education of the consuming public progresses. A double superphosphate has been turned out by one company containing 45 per cent available phosphoric acid and 11 per cent nitrogen. The future of this industry is somewhat problematical. Undoubtedly the phosphates will always be American in origin and there probably will be a strong tendency on the part of the large meat-packing establishments to dispose of their tankage at any price, rather than have the problem of disposal in other ways on their hands; so that animal nitrogen will always be a constitutent of American fertilizer. Where the rest of the nitrogen will come from depends on the success of the synthetic nitrate and ammonia industry in America. The third ingredient, potash, will have the hardest fight of the trio, but American producers of potash hope to be able to hold their own against the German and French.

Under former conditions, the American farmer averaged about 30 bushels of wheat on 2 acres, whereas the English farmer would raise 30 bushels of wheat on 1 acre. But this procedure has been profitable to the American wheat grower, due to his economic status.

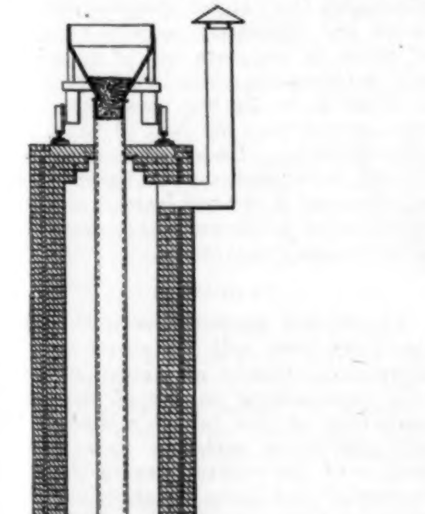
Recent Chemical & Metallurgical Patents

American Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Tungsten Trioxide.—S. J. Lubowsky of Jersey City has assigned to the Metal & Thermit Corporation a process for preparing pure tungsten trioxide from tungsten ore. The process is quite simple, as it consists only in roasting the ore with chloride or chlorate of an alkali metal at a bright red heat. The broken up roast is then treated with concentrated mineral acids, which turn into solution many of the original impurities. The solid residue is washed with ammonia liquor and the resulting solution evaporated and calcined to get rid of the last traces of ammonia. It looks fairly simple after you get by the first roast, but the author talks about temperatures at 1,700 deg. F. and that confines you pretty well to the less volatile alkali. Even at 1,200 to 1,400 a lot of alkali would be lost. (1,410,584; March 28, 1922).

Manufacture of Lithopone.—James A. Singmaster and Frank G. Bryer, of Palmerton, Pa., have assigned to the New Jersey Zinc Co. the following patent on the manufacture of lithopone. In principle, it reminds one very much of the ethylene furnaces used in the Chemical Warfare Service, this indirect fired muffle for the continuous production of lithopone. A reproduction of the apparatus is given herewith and is practically self-explanatory. The dry cake of zinc sulphate and barium sulphide is fed in to the hopper at the top of the stand pipe, which is 25 ft. long and 10 in. in diameter. The discharge at the bottom is carried out by means of a star wheel and empties directly into a tank of water. The dimensions of the muffle are extremely important, inasmuch as the experimenters have found that a 12-in. pipe of the same length produces a very irregular product, while a 10-in. pipe produces unusually good material. The temperature is accurately controlled by means of the thermocouple shown in the diagram at the base of the vertical shaft, and this precaution follows the experimental work carried out at the New Jersey Zinc Co., which has shown the existence of critical temperatures for lithopone. The apparatus looks like a distinct advance over the old rotary muffle, which was horizontal and which had large volumes of gas above it. This last was a source of continual trouble, as the lithopone is very sensitive to the composition of the atmosphere in which it is muffled. The invention further has the distinct advantage of continuous operation, and on the face of it, looks like a big advance in manufacturing process. (1,411,646; April 4, 1922.)



Heat- and Moisture-Resistant Leather—For certain purposes it is desirable to have leather which is extremely resistant to heat and moisture. Such leather can be economically manufactured by a combination of pyrophosphate and chrome tanning methods. The process may be carried out by first treating the prepared hides with a solution containing sodium pyrophosphate, ammonia alum and salt, adding single bath chrome liquor to the spent solution, or the chrome liquor may be added gradually during the pyrophosphate tanning. For general purposes the range of relative proportions of alum to pyrophosphate may be from 5 : 1 to 7 : 1, while the amount of standard chrome liquor will vary from a fraction of 1 per cent up to 8 per cent. (1,415,671; Ernest W. Merry, of Sheffield, England, assignor to Pyrotan Leather Corporation, Wilmington, Del. May 9, 1922.)

Rotating Leer for Lamp Bulbs—In a rotating cylindrical chamber, articles of a conoidal shape will gradually progress through the cylinder in the direction of the apex of the conoid. A cylindrical object in a rotating conoidal chamber will move toward the base of the conoid. These observations were utilized by James Bailey, of Corning, N. Y., in designing a rotating leer for annealing glass articles of suitable shape, such as lamp bulbs. It was also found that if the bottom of the chamber were inclined to the horizontal, while the driving effect of the rotation of the chamber on articles capable of being set in rotation, there was sufficient to cause such articles fed to the lower end to move upwardly through the chamber, broken particles and fragments not of proper cross-section to be set in rotation will slide down and fall from the charging end, thus causing the device to act as a separator. Accordingly, the leer is formed of inclined cylindrical pipe arranged so that it can be rotated and heated externally. The bulbs are fed in at the lower end and the fact that they are rotating constantly while passing through the leer assures uniform annealing. Broken bulbs which cannot be set in rotation will not feed through but will drop out at the charging end. (1,416,595; assigned to Corning Glass Works. May 16, 1922.)

Refractory From Chromite Tailings—Tailings from the concentration of disseminated chromium ore are pulverized, mixed with tar or pitch as binder, and pressed into bricks which when burned are found to possess satisfactory refractory qualities. The tailings contain only about 5 per cent chromite, the remainder being silica, alumina, serpentine, olivin and magnesite. (1,418,648; Robert W. Hull, of Hingham, Mass. June 6, 1922.)

Artificial Corundum — Harold A. Richmond and Robert MacDonald, Jr., of Niagara Falls, have taken out a patent for the manufacture of artificial corundum. In some experimental work they discovered that corundum for fine grinding such as surface grinding, cutting and knife grinding and automatic cylindrical grinding could not be made from bauxite or emery as a raw material. This was due to the presence of titanium in the raw material. By selecting a natural corundum ore substantially free from titantium they have eliminated this objection. The product will also be free of aluminum carbide if the process is properly controlled. The crystals are said to be stronger and denser than those made from anhydrous alumina, which is also more expensive. The process is not in itself very different from the present process, except that a natural corundum free from titanium is used. Steel chips are added in quantities sufficient to make the total iron in the charge more than three times the amount of silicon present, so that the resulting ferrosilicon will be magnetic. Pulverized coke is also added so that reduction of the silica and iron oxide will take place. To get the best results titanium should not exceed 1 per cent and iron and silica should not exceed 2 per cent each. (1,413,785; April 25, 1922.)

Vulcanizing Rubber—Rowell C. Naylor, of Springfield, has invented a new accelerator, which he claims is very satisfactory. It consists in incorporating phenylhydrazine in the rubber mix. This gives a very even spongy rubber, so that vulcanization in a mold can take place very readily. The formula he suggests is 89 parts by weight of rubber, 5 parts by weight of sulphur, 5 parts by weight of black substitute and 2 parts by weight of phenylhydrazine. For the information of those unfamiliar with rubber, it might be added that black substitute is the trade name given to a compound formed by boiling a raw or oxidized oil, such as corn oil with sulphur. Vulcanization takes place in 45 minutes, with 50 lb. of steam pressure, which would be a very satisfactory vulcanization period. (1,418,215; June 6, 1922.)

Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields—Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

Muscle Shoals Minority Favors Ford

Senator Ladd Submits Report Strongly Recommending Acceptance of Manufacturer's Offer—Opposition Also Presents Arguments

INTEREST in Washington has again focused on the Muscle Shoals situation. Friends of the Ford offer are apparently determined to die hard. Now that the real estate promotions and chimeras of newly created industrial giants in the South have received an awakening jolt by the majority report of the Senate Committee on Agriculture, the general tendency is to omit fireworks and subject the main possibilities to a logical survey. Senator Ladd has presented the views of the minority of the Agriculture Committee—an earnest attempt to argue the acceptance of the Ford offer. It is refreshing to note that flag-waving does not predominate in the report and that the "benefits that would accrue to the people" are left to the judgment of the legislators. It is emphasized that the minority does not claim that the Ford proposal is without objection. They do not forecast nor prophesy that its acceptance will bring the millennium. But it is feared that if the offer is rejected, the waste and the losses at Muscle Shoals since the armistice will continue increasingly.

The present fuel and transportation emergencies are pointed to in the report to emphasize the fact that the development of such great hydro-electric power as is found at Muscle Shoals seems to be the only certain and permanent relief in the future from the present paralysis of American industry.

It is admitted in Mr. Ladd's report that certain objections to the Ford offer seem apparent, but it is felt that none of the objections to the Ford offer can be remedied or solved by government ownership and operation at Muscle Shoals—by the government going into the power business or entering the hazardous field of operating nitrate plants at Muscle Shoals in the production of nitrogenous and other commercial fertilizers using electrochemical processes the commercial success of which is yet controversial. "For Congress to adopt such a policy, when Henry Ford's offer makes it unnecessary for the government to do so, would subject Congress to the just condemnation and reproach of all sober-minded people," says the report.

Senator Ladd's report then gives parallel quotations from the bill providing for lease and sale to Henry Ford and from the bill providing for government ownership and operation, and summarizes the Ford offer under twelve headings. The report then states what are considered as the four main advantages which will follow the acceptance of this offer:

Contribution to Defense

First, it will contribute to our national defense by providing a supply of the indispensable nitrates that must be had for the manufacture of explosives in time of war. The primary object in undertaking the Muscle Shoals project was to provide a supply of fixed nitrogen for explosives. Mr. Ford's offer agrees to maintain Nitrate Plant No. 2 for 100 years ready for immediate use, to carry on a program of research to determine the most improved methods of operation of such a plant, and to operate this plant continuously for the period of the lease.

Reduction in Fertilizer Price

Second, the Muscle Shoals project, under the Ford offer, provides a large-scale production of fertilizer under the most favorable conditions, which cannot fail to reduce the cost of fertilizer to the farmer. Confidence in this reduction of cost is held because of the statements of F. S. Washburn, who introduced the cyanamide process in this country, and because of the statements of the byproduct coke-oven interests in requesting protection for their ammonium-sulphate product, when they stated that fertilizer produced by the cyanamide process in Germany could be sold in this country at one-half the price of their product.

In any case the evidence is convincing to the minority of the Committee on Agriculture and Forestry that modern processes can be applied at Muscle Shoals in such a way as to reduce this cost and they feel that Mr. Ford has the cash to develop and adopt these processes. It is felt that the farmer can look for but little reduction of prices from the present fertilizer interests, who, protected by the Chilean export duty, are now asking for an import duty of $12 per ton in addition.

Development of Water Power

Third, the project developed under the Ford offer will contribute to the advancement of industry by introducing a plan of water-power development which provides the means whereby hydro-electric power ultimately may be had in the United States as cheaply as in the more naturally favored countries such as Canada and Norway.

Since a hydro-electric plant costs a great deal to construct and but little to operate, there is a feature of hydro-electric power economics well known to those in the business, that the general public probably does not appreciate. When the items which go to make up the cost of hydro-electric power at the switchboard of the generating station are examined, it is found that under the conditions of construction and financing existing in the United States, the single item of interest on the investment constitutes 80 per cent or more of the cost of the power.

Mr. Ford proposes to eliminate the interest by amortizing and returning the investment, through the operation of a long-time sinking fund. He therefore provides a series of payments which, when invested in a sinking fund at as low a rate of interest as 4½ per cent, will return the entire cost of both dams, including the $17,000,000 already expended by the government. This eliminates the capital charges and interest and ultimately reduces the cost of power to the mere cost of operation and maintenance, which in a large plant is from $1 to $3 per horsepower per year, or less than one-half of 1 mill per kilowatt-hour. Under this plan the bonded indebtedness on a water-power development is reduced instead of being increased as is the customary procedure in refinancing operations.

Navigation

Fourth, the project developed under the Ford offer will contribute to the early completion of permanent navigation improvement on one of the most important of our inland streams. It will provide an outlet by water for a section of the country having a great variety of useful raw materials and will do so under a plan which may be applied on other American power streams whereby the water power furnishes the government with its navigation facilities without cost.

This contribution to navigation is

(*Continued on page* 278)

Wood Pulp Goes on Free List

By a vote of 22 to 30 the Senate rejected the Finance Committee recommendation for a duty of 5 per cent ad valorem on chemical wood pulp. The tariff was urged by Chairman McCumber of the Senate Finance Committee, who said the industry is important and can produce for an indefinite period if given a protective tariff.

Chemical Manufacturers Demand Reinstatement of Dye Embargo

G. A. O'Reilly Tells Synthetic Organic Chemical Manufacturers That Facts Must Be Presented to Legislators if Industry Is to Receive Consideration

DECLARING that the American chemical industry will be unable to survive the ruthless competition of the great German cartel unless the embargo on foreign dyes is continued, fifty members of the Synthetic Organic Chemical Manufacturers Association of the United States unanimously petitioned the Senate Finance Committee to reinstate the protective provisions which had been eliminated after the close fight in the Senate on July 15.

This action followed an all-day session at the Hotel Pennsylvania, New York City, where Dr. Charles H. Herty, president of the association, and George A. O'Reilly, vice-president of the Irving National Bank, led in the discussion of this serious problem of the domestic organic chemical industry. The unfavorable action of the Senate was attributed by Dr. Herty to the confusion resulting from the controversy between the government and the Chemical Foundation. In the course of his discussion he declared:

"It is my belief that the recent vote in the Senate, sitting as a committee of the whole, was due to a confusion of thought in the minds of several Senators between two issues—patents and protection for this industry. This confusion arises, I believe, from the recent action of the government in connection with the Chemical Foundation. Logically this has no connection with the consideration of the question of adequate protection for this vitally important American industry.

"I sincerely hope that the confusion of thought which existed at the time the vote was taken in the Senate striking out the provisions placed in the bill by the Senate Finance Committee will be cleared away and that these paragraphs will be reinserted in the measure before it is passed.

"Unless this is done, I foresee the ruin of the American industry by the great German chemical cartel, with its 50 years of experience and its vast resources, which has been so strenuously fighting us through its agents in this country."

Banker Presents Views

"The trouble with your industry is fundamental, not incidental," said G. A. O'Reilly, addressing the association at the luncheon which was held between the morning and afternoon sessions.

In a spirited address Mr. O'Reilly declared that the chemical industry will never receive the consideration it deserves, either by the public or by Congress, until the futility of telegrams to Senators, delegations to officials and resolutions by societies is realized and the industries send to Washington the best men they have to "put over" their story. And these men must not be the theorists, or the talkers, or the wind merchants, but they must be the pick of the industry, the men who know more about their business than anyone else in the country—its history, its theory, its problems and its business phases. When the chemical industry adopts such a policy there will be less talk of the "blockheads in Washington" and less need for resolutions of protest.

Mr. O'Reilly is probably as familiar with the present-day problems of the chemical industry as anyone in the country not directly connected with it, and at the same time his viewpoint is impartial and unprejudiced.

Bankers are conservative by nature and by necessity. When approached with a new venture, their attitude is inevitably skeptical and before they will agree to back the new undertaking they must be convinced that it is sound, and convinced by irrefutable facts. In the absence of such conviction American bankers are still skeptical of the American chemical industry. Chemistry is out of their line. They know nothing about it. Consequently, the chemical venture can scarce hope to enlist their support.

"We bankers are coming out of our shells. We have begun to learn that we have to put our business forward as everyone else does who has anything to sell. You should break into the banking situation. Break into the banking consciousness. They would be glad to get into this with you. But we do not know. We are uninformed and misinformed."

Advertising Needed

The same situation exists with regard to the legislators. With one or two possible exceptions, our Congressmen are not "sold" on the American chemical industry any more than are the bankers or the public as a whole. In the face of adverse legislation the chemical industry has reached the point where it throws up its hands in disgust and exclaims, "What's the use, with such blockheads in Washington?"

Such an attitude is not only unjust but it betrays ignorance, said Mr. O'Reilly. The fact of the matter is that the great majority of our lawmakers are doing the best they can with something they don't know anything about. And the blame for this ignorance can fairly be laid at the door of the industry. The most earnest plea and the most patient explanation of one or two legislators who know enough about the chemical industry to lend it full support will be regarded merely as the propoganda of "special interests" until their colleagues—and, more important still, their constituents—are brought to realize the fundamental place that the chemical industry holds in their everyday lives.

Efforts Are Misdirected

The solution demands the adoption of a new policy by the industry, said the speaker. It demands a revised opinion of the mental capacity of our Congressmen. It demands the education of the individual and of the public to the true importance of the chemical industry and an education based not on resolutions, or petitions, or protests, but on facts. The representatives in Washington of the industry must be men with a broad knowledge and thorough understanding of the details and figures of the business they represent. Our Congressmen are swamped with telegrams and with the resolutions of a thousand and one organizations. They are forced into a skeptical attitude by a multitude of demands that are entirely one-sided and selfish. The one solution for the chemical industry is a concerted effort to advertise itself—to "sell" the idea of chemistry to the people of America.

The failure of the dye embargo, the antagonism to the C.W.S. and the Chemical Foundation situation are due to the same reticence.

(*Continued on page* 277)

Oil Discoveries Reported in Northern Alberta, Canada

Reports from the neighborhood of Fabyan, near Wainwright, where the Imperial Oil Co. is boring for oil, assert that the company has struck a heavy flow of oil, which flowed outside the precincts of the company's barbed-wire entanglement and converted the dust of the district into an oily mud. The company, however, refuses to confirm the report. The result of the rumor has been another run on the Dominion land office at Edmonton and filing of a large area of ground in the vicinity of the reported strike.

A number of companies are boring for oil at and near Pouce Coupe, which is situated close to the interprovincial boundary between Alberta and British Columbia. It will be remembered that the Imperial Oil Co. struck a heavy flow of gas in a well at Pouce Coupe last year. The gas has been shut out, and the well is now down 2,160 ft. The drill has passed through several strata of oily sand, and, it is said, will be continued to 4,200 ft., unless a commercial flow of oil is struck sooner.

The Pouce Coupe Oil Co. has a diamond drill in operation 10 miles to the south of the Imperial company's well, and is down 500 ft. and sinking at the rate of 60 ft. daily. The drill has a capacity of 3,000 ft.

The Great Slave Oil Co. is operating a similar outfit near Rolla, and is down 400 ft.

Northern Alberta Oil Fields, Ltd., has freighted in a large Californian drilling outfit, and is waiting instructions as to the particular point at which it is to be erected. The Mackenzie River Oil Co. has a similar drill in transit to Rolla.

National Safety Council Announces Its Annual Meeting

Detroit Scene of Elaborate Sessions, Including Many Discussions of Interest to Chemical Industries

THE eleventh annual meeting of members of the National Safety Council is announced for the week of Aug. 28 in Detroit, Mich. Sessions will be held in the Cass Technical High School and judging by the program as it stands to date, the proceedings will be of very lively interest, not only to safety workers but to many of the chemical industries. Among the speakers at the four days of meetings appear the names of many well-known engineers and executives of the chemical and allied fields.

The business of the Council will be disposed of at the opening session on Monday morning, Aug. 28. The general session the same afternoon will be under the chairmanship of George A. Walters, Deputy Commissioner of Police in Detroit, and a number of papers on the general status of safety work will be presented, among which is one by A. H. Lichty, vice-president of the Colorado Fuel & Iron Co. of Denver.

The general subject of plant publications and their function in spreading the safety habit will be discussed on Tuesday, under the chairmanship of A. Ellis Frampton, of the Hammermill Paper Co. of Erie, Pa.

General Session

The general session on Tuesday, Aug. 29, under the direction of H. W. Forster, vice-president of the Independence Bureau, Philadelphia, Pa., will include several papers of more than passing interest to chemical engineers. M. F. Crass, of the Grasselli Chemical Co., will read a paper on "Safety in the Handling and Use of Acids." F. A. Rogers, of Lewis Institute, Chicago, Ill., and H. H. Brown, of Norwood, Mass., will discuss static electricity, its occurrence and its hazards in industry, with special reference to safety devices for preventing or overcoming the danger. The discussion will be led by L. A. De Blois, of E. I. du Pont de Nemours & Co.

A general round table will be conducted by C. W. Price, of the Price-Rasmussen Corporation of Chicago, Wednesday afternoon. The program includes papers on several phases of accident prevention. J. M. Woltz, of the Youngstown Sheet & Tube Co., is chairman of the "ABC" session on Thursday morning and R. S. Quinby, of the Hood Rubber Co., will direct the discussion that afternoon on "Sanitation and Factory Housekeeping."

Section Meetings

Of special interest to the chemical industries will be the meetings of the chemical, cement, packers' and tanners', paper and pulp, petroleum and rubber sections. The chemical section is headed by S. H. Kershaw, of the Hercules Powder Co. Included in the program are papers by the following:

Walter G. Whitman, assistant professor of chemical engineering, Massachusetts Institute of Technology: "Safe Handling in Chemical Plants."

F. J. Hoxie, Associated Factory Mutual Fire Insurance Companies: "Preventing Vapor and Gas Explosions."

A. L. Watson, Hooker Electrochemical Co.: "Report by Industrial Poisons Committee."

Charles F. Horan, Hood Rubber Co.: "Benzol Poisoning, Its Occurrence and Prevention."

The cement section will discuss accident problems of the industry. The packers' and tanners' section has scheduled several papers relating to the welfare of workers in the packing and leather industries and to the efficient conduct of safety departments in those industries. The paper and pulp section is under the chairmanship of W. A. Gleason, of the Hammermill Paper Co., and the program includes papers on the special problems that confront the safety workers in the pulp and paper mill, particularly the hazards of unguarded machinery. In the petroleum industry, dangers are more likely to exist in the combustion of fuel oil or petroleum distillates, and several of the papers will touch on these hazards and their prevention. The rubber section will arouse considerable interest, as several papers are to be presented by delegates from the large rubber companies and a wide variety of subjects will be discussed. This section is under the chairmanship of H. T. Martin, of the Fisk Rubber Co. Besides the reports of several committees their sessions will include a talk entitled "Vulcanizers," by C. W. Cook.

Motion pictures, as usual, will contribute to the breadth of the sessions. A number of new films have been obtained and will be shown to demonstrate both new ideas in safety measures and the means that are being adopted to spread the council's propaganda.

An informal banquet will be held Thursday evening, for which several interesting features have been arranged.

American Institute of Chemical Engineers Plans Meeting

The American Institute of Chemical Engineers will hold a dinner in New York during the week of the Chemical Exposition, Sept. 11 to 16. Preliminary plans announce that the dinner will be held on Thursday. It will be preceded by a Council meeting. Ladies are to be invited to attend the dinner. Further announcement will be made when plans are completed. The arrangements are in charge of a committee of which David Wesson, of the Southern Cotton Oil Co., is chairman.

Federated Engineering Societies to Meet in Boston

Findings in a nationwide survey of the three-shift day in American industry will be placed before the executive board of the American Engineering Council of the Federated American Engineering Societies, at a meeting of the board to be held in Boston on Sept. 8 and 9.

Two reports, dealing with exhaustive investigations of the two-shift and the three-shift day problems in numerous industries will be presented. One, prepared by Horace B. Drury, formerly of the faculty of Ohio State University, will describe the extent of 2-shift operations in the continuous industries as well as the procedure followed and the results noted by those companies which have changed from the 2-shift day of 12 hours each to the 3-shift day of 8 hours each. Mr. Drury's report will discuss the general practicability of abolishing 12-hour turns.

Among the industries investigated are the metals, glass, cement, lime, brick, pottery, chemicals, sugar, salt, petroleum, cottonseed and other vegetable oils, paper, flour, rubber, gas, water and ice.

A second report on an investigation of the *modus operandi* involved in changing the operations of a steel plant from 2-shift to 3-shift methods will be made by Bradley Stoughton, former secretary of the American Institute of Mining and Metallurgical Engineers. Both investigations are being directed by the American Engineering Council's committee on work periods in continuous operation industries.

Many national economic, political and social problems bound up with engineering will probably also be considered at the Boston meeting. The question of government reorganization, involving a proposal to establish a national department of public works, reforestration problems, international affiliations with engineering societies, flood control and water supply, and plans for the country-wide expansion of the Federated American Engineering Societies will be discussed, in addition to reports of numerous committees which are considering questions of national interest.

Mortimer E. Cooley, dean of the Engineering Schools of the University of Michigan, will preside.

Acts on Foundation Patents

The committee on procedure adopted and sent to President Harding a resolution expressing the hope that no action will be taken by the federal government regarding the recovery of patents from the Chemical Foundation until representatives of chemists, chemical engineers, chemical manufacturers, the medical profession and others most directly concerned are heard.

The resolution "implores that nothing be done which can, in any way or to the slightest extent, tend toward the ultimate return to former owners, of patents or other property, lawfully sequestered and sold to Americans."

Japan Rejects Proposal for Dye Embargo

Old Tariff of 35 Per Cent ad Valorem Must Meet Condition Analogous to That in U. S.

Japan has declined to grant either a dye embargo or higher rates to protect it from foreign imports, according to a cablegram from Commercial Attaché Abbott, at Tokyo, received at the Department of Commerce. The dye situation in Japan is analogous to that in America, the industry having been developed since the war and just becoming established. Recent cablegrams had indicated that the licensing system would be adopted, hence the final report came as a surprise. The domestic manufacturers were asking an increase in duties of from 35 per cent ad valorem to 70 per cent and a licensing system to cover eighteen colors satisfactorily produced in Japan.

The market for Japanese dyestuffs is now limited to buyers in nearby Oriental markets, and even then quotations and sales must be made at an extremely low price. The local Japanese market is quite overstocked with German goods, against which American, French and Italian dyes are competing. On the other hand the depressed conditions of the textile trade furnishes little relief for the excessive stock of dyes.

It is indicated that the present rate of 35 per cent ad valorem will stand without any increase, and that no special provisions will be adopted.

The total requirements of Japan amount to approximately $15,000,000 annually. Of this amount imports are about 50 per cent. Recent importations from Germany and Italy have amounted to about $7,000,000 annually, with $500,000 from the United States.

The colors of Japanese manufacture which are generally giving a degree of satisfaction in the home market and for which protection against imported goods is desired are: Rhodamine B, aniline methyl violet, bismarck brown, fast red A, malachite green, direct black, naphthol brown, cotton violet, sulphur black, sulphur brown, magenta, orange A, and Congo red.

Grasselli Gets Freight Refund on Iron Pyrites Shipments

The Grasselli Chemical Co. is to receive a refund of about $2,000 from the railroads which levied unreasonable freight rates on shipments of iron pyrites between DeKalb and Newcastle, Pa. The Interstate Commerce Commission, in an opinion just handed down, has ruled that the freight charges were unreasonable to the extent that they exceeded $3.90 per long ton. The shipments were made when labor troubles prevented the obtaining of supplies of zinc ore at the company's sulphuric acid plant. Iron pyrites were substituted and 43 carloads were moved. A rate of 5.30 was assessed on the ground that it was a sporadic movement. The commission decided that in view of the fact that 3,163,660 lb. had moved the chemical company was entitled to a rate which would accord with the general ton-mile earnings within the territory concerned.

In the complaint of the Arlington Silver Mining Co. an examiner of the Interstate Commerce Commission has recommended that rates on ore from Okanogan to Tacoma, Wash., be held unreasonable.

Unreasonable rates on bauxite ore from various points to Omaha are alleged in a complaint to the Interstate Commerce Commission by the Metropolitan Utilities District of that city.

Experimental Therapy Institute Planned for Philadelphia

The creation of a national institute of experimental therapy, to have relatively the same scope as the Rockefeller Institute in pathology or the Mayo clinics in surgery, is the plan of Rear Admiral William C. Braisted, retired, for the expansion of the Philadelphia College of Pharmacy and Science, of which he is president.

The college soon is to leave its present site for newer and more commodious quarters in West Philadelphia. A plot has been acquired in this section of the city and work on the new college edifice will begin within the year.

Demand Dye Embargo

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The speaker cited as an example of what could be done by the intelligent presentation of the facts the case of the manganese producers in the recent tariff wrangle. The position of the manganese producers threatened to be even less enviable than that of the dye manufacturers, but the businesslike efforts of capable representatives succeeded in convincing the legislators that the industry needed and deserved protection.

Manufacturers' Petition

The petition sent to members of the Senate Finance Committee read as follows:

> At a meeting of the Synthetic Organic Chemical Manufacturers Association of the United States, held at New York, Aug. 4, 1922, the undersigned manufacturers of dyes, drugs and other organic chemicals gave consideration to the serious danger that threatens their industry by reason of the defeat of the dye and chemical control act in the Senate, July 15. They now respectfully petition the Finance Committee to take such action as may be appropriate to reinstate the clauses in the tariff act stricken out by the Senate's action. They repeat what they have heretofore testified to before your committee, that nothing less than the provisions of the dye and chemical control act will adequately protect their industry; that no specific or ad valorem rates will prevent the German cartel from regaining absolute control of the American organic chemical market; and that the manufacture of dyes, medicinals and other organic chemicals can no longer be maintained in this country without the legislative protection heretofore advocated by your committee after thorough investigation of all the facts.

The business meetings were, as usual, conducted behind closed doors.

A.C.S. Secretary Reports on Conditions in Europe

After a visit to several European countries, during which he attended meetings of the International Union of Pure and Applied Chemistry and of the Société Chimie Industrielle, C. L. Parsons, secretary of the American Chemical Society, returns to this country with the report that the chemical industry in Germany is booming, but in the other European countries it is having great difficulty in emerging from the depression.

Germany is employing in the European countries the same questionable methods it is using in this country to regain its chemical supremacy, says Dr. Parsons, the only difference being that the German efforts are less effective abroad because the Europeans know them better. The consumers of dyes in European countries, Dr. Parsons asserts, seem to have more vision than those in this country and do not permit themselves to be made the agency through which Germany is trying to attain her ambitions. Then, too, officials in high places in England are not permitting themselves to be used to the permanent injury of their country's chemical industry, he says. There is no counterpart of Senator Moses in the English Parliament.

Nevertheless, Dr. Parsons reports, such headway as the Germans have made in the European countries has been by employing the same methods they have used here by obtaining a certain amount of co-operation with shortsighted consumers of their products and by having the whole-hearted support of importers.

Dr. Parsons was particularly impressed during his trip by the disdistinct advances which the English have made in the oxidation of ammonia; by the success and great possibilities of the new process for vulcanizing rubber by the action of sulphur dioxide and hydrogen sulphide; by the remarkable results made in the enameling of iron, and by the efficiency which the French have achieved in applying two colors in the same dyeing vat.

During the meetings which Dr. Parsons attended, several references were made to the advantages which American chemists possess by having only one national organization. The influence of chemists in several countries in Europe is impaired materially, it was stated, by multiplicity of organizations.

National Lead Charged With Price Fixing

A complaint of unfair competition has been made by the Federal Trade Commission against the National Lead Co. It charges the company with enforcing a system of fixing and maintaining specified standard prices at which its white lead, litharge and paint products are sold, through a system of support and co-operation of wholesale and retail dealers.

Minority Favors Ford

(Continued from page 274)

regarded as an important part of the Ford offer and an added reason for its acceptance.

Objection to Ford Offer

One of the principal objections to this offer lies in the 100-year lease. The Ladd report, in view of the fact that the rights of those with whom Mr. Ford would compete are either perpetual or not less than 99 years, feels that this time of lease is only fair.

It is also claimed that acceptance of the offer would give Mr. Ford a government subsidy in the development of power and the manufacture of fertilizer.

In rebuttal, the report cites a comparison between the Ladd bill and that proposing federal relief for the merchant marine, showing that the former called for an expenditure of $42,000,000, while the latter required an expenditure of $125,000,000, and asks how the subsidy to ship operators can be supported, while the Ford offer is condemned on the same grounds.

The Matter of Repairs

It has been maintained that the $55,000 payable by Mr. Ford annually for the maintenance and operation of the locks and dams, outside of the power houses, is insufficient but the Chief of Engineers has testified that this is a sufficient sum (House hearings, p. 19), and his testimony is confirmed by the experience of the Reclamation Service, for it is shown in the record that such large dams as the Arrow Rock (about half the size of Dam No. 2, 349 ft. high), built in 1915, has required an average for the maintenance expense of $950 since it was completed, the amount for the calendar year 1920 being only $567. This is not an isolated exception, as is evident from the record of seven large dams, the most expensive of which in 1920 was the Pathfinder Dam, 218 ft. high, built in 1909, which required $1,304 for its maintenance.

As in the case of the nitrate plants, the dam was started during a wartime period of maximum prices and minimum efficiency of labor, and since the total cost of the dam, equipped with 125,000 hp., was estimated in normal times to be $14,500,000, it is reasonable to say that the actual normal value of the work done is probably not over 50 per cent of the $17,000,000, or about $8,500,000. The United States engineers, after careful studies extending over several years, reported that the amount chargeable to navigation on a pre-war basis of cost was $8,575,000. The record therefore indicates that the value of the work done to date is an approximate measure of the amount which should be charged to navigation. Through the operation of the Ford amortization fund, however, if the money is placed at only 4½ per cent, the table given by the Secretary of War shows that the resulting fund would repay to the government not only the entire cost of completing the project but the full amount of the present $17,000,000 investment as well, the total amount returned being $70,100,000.

The Question of an Amortization Fund

It has also been contended that the government could not administer an amortization fund and that it does not do so. The administration of a sinking fund is nothing new to the federal government. The act of Feb. 25, 1862, provided that all duties on imported goods shall be paid in coin, and that the coin so paid should be set apart as a special fund known as a sinking fund which, together with the interest on the same, should be applied to the purchase or payment of the public debt as the Secretary of the Treasury should from time to time direct. The operation of a sinking fund in a long-time contract such as the Ford offer proposes can secure the most valuable results, and should be adopted. This fund, through the Federal Reserve Board and the Farm Loan Bank systems, should be placed at not less than 4½ per cent. If the fund was to be placed today, it could be placed in farm loan bonds at 5 per cent.

Senator McKinley Argues the Other Side of the Case

Complying with a request from Gray Silver, the Washington representative of the Farm Bureau Federation, Senator McKinley of Illinois has reduced to writing his arguments against the acceptance of the Ford offer. Senator McKinley's letteer was inserted in the *Congressional Record* of July 31. The opinion was expressed on Capitol Hill that the McKinley argument is much more likely to be effective than some of those which are less dispassionate. The text of the McKinley letter is in part as follows:

Government Deprived of Revenue

The testimony of the United States engineers who are in charge at Muscle Shoals shows that with the auxiliary steam power which the government has bought and paid for and which it is proposed to give Mr. Ford 200,000 hp. can be depended upon for practically every day in the year and an additional 150,000 to 200,000 hp. for 10 months in the year. Under the present standard of electrical art this power can be distributed to towns and cities, mines, and manufacturing plants covering a circle of 600 miles in diameter, thus providing untold advantages for a very large section of the United States. Power of this kind delivered from Keokuk over parts of the western and southern Illinois sells at the dam for about $40 per horsepower per year, which would mean a revenue to the government for the Muscle Shoals power of not less than eight or ten million dollars per year if the government should sell same to a distributing company at same price. This is figured on a basis of about one-half of 1 cent per kilowatt-hour.

One objection I have to Mr. Ford taking over this power under his present plan is because he proposes to deprive thousands and thousands of people over an area of 600 miles in diameter of power and its use in order that he may build up at Muscle Shoals a new Detroit. That is a fine thing for the inhabitants of Muscle Shoals, and naturally they are extremely desirous of seeing their real estate advance in value from $50 per acre to $10,000 an acre, but it is a bad thing for the thousands and thousands of people within this 600-mile area. This power which will wholesale at $10,000,000 per year will retail for over $50,000,000 per year. Mr. Ford proposes to buy from the government for $5,000,000 what has cost the government $150,000,000 and pay 4 per cent interest on the additional forty or fifty million dollars which the government must invest to complete the dams, and in addition to that he proposes to pay the government $46,000 a year, which he calls amortizement, and $55,000 a year, which he calls repairs.

Repairs to Cost More Than Ford Allows

The testimony of the army engineers is that the repairs at the dams will be about $227,000 a year, and not $55,000 a year. As Mr. Ford is to have the benefits if he gets this property on his terms and is to have these benefits for 100 years, he certainly, instead of offering to pay $55,000 a year, ought to agree to keep the dam in repair, which the army engineers say will cost $227,000 a year.

Mr. Ford does not propose to take this property, but to have a $10,000,000 corporation take title to it, and this title stands for 100 years. The experience with all large capital investments as corporations is that sooner or later, within 10 or 20 years, they pass into control of large money holders commonly known as "Wall Street." Mr. Ford, if he secures this property, gets the property tax free for 100 years, with no control of any kind as to what price he should charge for power. He requires the government to install, at government cost, machinery for 850,000 hp. and agrees to use 100,000 of of this power to make 40,000 tons of ammonia, which would make an amount of fertilizer which would not be sufficient to fertilize one-third of the acreage of Illinois alone, not including any other state, and he only agrees to furnish this provided he can sell at a profit of 8 per cent on the 4 per cent interest money he has secured from the government. The testimony of the army engineers who have had this property in charge since its inception is that with Chilean nitrates, or ammonia made from the byproducts of coke ovens, power must be secured at three-quarters of a mill per kilowatt. They further testify that, not getting any interest on the money the government has already invested, and 4 per cent on the additional money which the government must invest under Mr. Ford's offer, it would cost 2½ mills per kilowatt to generate the power, or three times as much as they testify that power must necessarily be provided in order to compete with present fertilizer.

Alpha Chi Sigma to Banquet During Exposition Week

Members of the chemical fraternity Alpha Chi Sigma have arranged to get together during the week of the Eighth National Exposition of Chemical Industries in New York City. Dinner will be held at 6:30 p.m., Thursday, Sept. 14, at Keen's Chop House, 107 West 44th St., New York City. In view of the fact that many members of the fraternity will be in New York attending the exposition, a large dinner gathering is expected.

Canadian Paper Co. Ordered Sold

Justice Morrison has ordered the sale on Oct. 13 of the Prince Rupert Pulp & Paper Co., and has appointed S. C. Hyatt receiver for the bondholders and creditors. Mr. Hyatt has been authorized to borrow $10,000 to pay license fees and taxes. The company passed the payment of interest on the first mortgage debentures on Jan. 1 and on July 1.

Personal

Prof. CHARLES S. BISSON has left the South Dakota School of Mines to take charge of the department of chemistry at the Northern Branch of the University of California, Davis, Calif.

G. G. CREWSON has resigned the plant managership of the Refractory Products Corporation's plant at Index, Va., to become associated with the engineering staff of the National Aniline & Chemical Co., Buffalo, N. Y.

EDWARD J. P. FISHER, metallurgical engineer, formerly with the Atlas Die-Casting Co., Worcester, Mass., is now with the Edison Lamp Works of the General Electric Co., at Harrison, N. J.

F. B. FOLEY has been transferred by the Bureau of Mines from its Minneapolis station to the station at Rolla, Mo. At his new location Mr. Foley will continue active experimental work on the production and heat-treatment of drill steels.

CARL E. JULIHN, who has been superintendent of the Bureau of Mines station at Minneapolis, has been transferred to Washington, where he will serve on the technical staff of the War Minerals Relief Commission for the coming fiscal year. In the absence of Mr. Julihn, T. L. JOSEPH is acting as superintendent of the Minneapolis station.

D. H. KILLEFFER, on the editorial staff of *Drug and Chemical Markets*, will, on Sept. 1, be the New York editor of the *Journal of Industrial and Engineering Chemistry*, succeeding R. T. Stokes.

MENGO L. MORGENTHAU of 431 Hudson St., New York, has presented to Prof. W. L. Estabrooke for use at the College of the City of New York, especially in connection with Dr. Estabrooke's courses in inorganic chemistry, a collection of over fifteen hundred minerals, valued at $25,000. The collection is beautifully incased and electrically lighted. It has been placed in the entrance hall of the chemistry building, now called Baskerville Hall in honor of the late Charles Baskerville, director of the department of chemistry 1904-1922. Mr. Morgenthau is a member of the class of 1874.

A. A. MURPHY has been appointed resident sales manager of the industrial and railway paint and varnish division of E. I. du Pont de Nemours & Co., with headquarters at New York.

C. J. MURPHY, vice-president of the Phoenix Leather Co., Pittsburgh, Pa., has resigned, effective Aug. 1, to become connected with the Deford Co., Baltimore, Md.

Dr. ROLAND P. SOULE, a graduate of the department of chemical engineering, Columbia University, has accepted a position with the Combustion Utilities Corporation, 24 State St., New York.

Among the notable additions to the Federated American Engineering Societies is the Engineers Club of Columbus, Ohio, which has appointed Prof. James R. Withrow of Ohio State University as its representative on the American Engineering Council, the executive organ of the federation. Professor Withrow will serve until Jan. 1, 1924.

Obituary

JOSIAH MONROE, for many years secretary and treasurer of the Juragua Iron Co., with plant in Cuba, died at his residence, Philadelphia, Pa., on July 26, following an illness of several weeks, at the age of 70 years. He is survived by his wife and a daughter.

CHARLES ADAMS PATTERSON, vice-president of E. I. du Pont de Nemours & Co., died on July 26 at the Presbyterian Hospital, Philadelphia. Mr. Patterson was taken to the hospital on July 10 suffering with a carbuncle. An operation was performed and was apparently successful until a few days before his death, when complications set in and septic pneumonia developed.

Mr. Patterson's death came as a shock to a multitude of friends, for he was in the prime of life and of a sturdy constitution. His unfailing good humor, keen aggressiveness and wholesome conviviality made him a true friend to literally hundreds of persons with whom he dealt. Charles L. Reese, chemical director of the du Pont company, says of Mr. Patterson: "He was a lovable character and a staunch friend—probably the most popular man in the company."

Mr. Patterson had spent his entire business life in the explosives industry, which he entered as an office boy with the Repauno Chemical Co. in 1894. From that position he advanced rapidly until he had become one of the best known and most important men in the world of explosives manufacture.

He was born at Minersville, Pa., April 9, 1876, the son of the late George Patterson, onetime manager of the black powder operating department of the du Pont company.

Mr. Patterson was graduated from the Wilmington High School in 1894, and he immediately took his first office boy position with the Repauno company. His desire for advancement led him to study shorthand at night and he was soon made stenographer and clerk to the late H. M. Barksdale, at that time managing head of the Repauno company. In September, 1896, he was granted leave of absence to enter college and he became a student at the University of Pennsylvania, taking the chemical course, in which he was graduated in 1900. During his college years he spent the summer vacations working in various plants of the du Pont company, so that on his graduation he was remarkably well equipped for his lifelong work in the explosives industry.

Immediately after his graduation he was employed as a chemist at the Repauno works and 3 years later was made assistant superintendent. During the succeeding 6 years he was successively superintendent at the Forcite works, the Barksdale works and the Hercules works, returning in May, 1912, to the Repauno plant as its superintendent.

Mr. Patterson's experience and managerial ability played an important part in the rapid expansion of the du Pont company's activities during the war. In May, 1916, he was made general superintendent of the du Pont company's high explosives operating department and a year later became assistant director of the explosives manufacturing department. It soon became necessary for him to take on more responsibilities and he was made director of the explosives manufacturing department and a short time later was elected a member of the board of directors of the du Pont company.

After the armistice Mr. Patterson was chosen as a member of the executive committee, charged with the duty of readjusting the company's affairs to a peace-time basis. He was elected a vice-president and was given general supervision of the explosives manufacturing department, in which position he continued until September of last year, when he was elected as general manager of the explosives department, which had been enlarged to include not only manufacture but also sales and all other activities connected with this branch of the company's business. This new position threw upon him a greater burden of responsibility, as it gave him the entire management of a branch of the business almost as large as the company's whole organization in the years before the war.

Mr. Patterson was always interested in educational matters and was particularly devoted to the interests of the University of Pennsylvania. He was closely identified with civic movements and was deeply interested in political matters. He had been chairman of the Republican County Committee for 2 years and had taken an active interest in several national and state campaigns.

Irenée du Pont, president of the du Pont company, paid tribute to Mr. Patterson in the following words: "The company has lost a vice-president whose knowledge and judgment were extraordinary and whose energy and loyalty were an example to all of us. Even more than that, his lovable character made him the friend of substantially every employee and thereby contributed in no small degree to the esprit de corps which has meant so much to the success of the du Pont company."

WILLIAM ANDREW THOMPSON, JR., vice-president of the Texas Co., New York, died suddenly on July 24, at his residence, 282 East Seventeenth St., Brooklyn, N. Y., aged 50 years. He was in charge of the export, marine and northern sales departments of the company.

Market Conditions

IN CHEMICAL, METALLURGICAL AND ALLIED INDUSTRIES

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities—Prevailing Prices and Market Letters From Principal Industrial Centers

The Trend of Production in the Chemical and Allied Industries

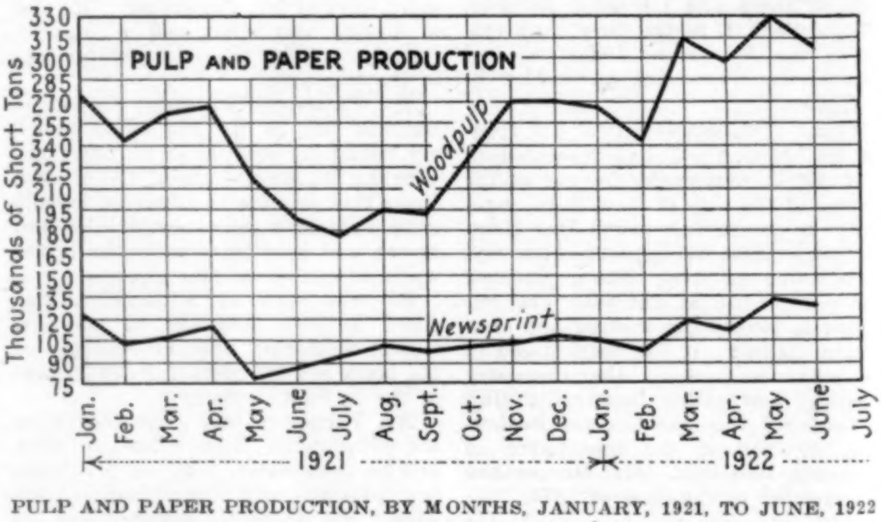
A Few Statistical High-Spots Along the Business Horizon—Manufacture in Some Lines Increasing in Spite of Strikes—Record Set by Paper and Rubber Industries

THE HARVARD ADJUSTED INDEX OF THE VOLUME OF MANUFACTURE. (*NORMAL = 100*)

As LATER STATISTICS of production are becoming available for the chemically controlled industries it is increasingly evident that the improvement noted during earlier months has been of a very general nature. Few if any of these basic industries have failed to respond to the stimulus of better times. Even at present in the face of strikes which threaten serious fuel and transportation shortages it is encouraging to know that the progress of production in certain lines continues practically without interruption. This demonstrates clearly the inherent strength of the present position of industry. The Harvard Service's adjusted volume index is gradually approaching the normal of 100, which is an average value determined on the basis of production in good and bad years and in which both seasonal influences and long-time tendencies have been considered. This index, which had risen to 93.7 in March, fell to 90.1 in April, but in May arose to 96.0—the highest point to be reached in the present movement.

Paper and Rubber Industries Set Records

Among the high-spots in production which have not already received comment on these pages is the paper situation. The output in May was the highest point which has been reached since 1920. As measured by the Harvard index, production had attained a value of 99.2 per cent of normal. In June there was a slight recession. Newsprint produced in that month was 127,230 net tons, as compared with 87,724 tons in June, 1921, and 114,440 tons as the 5-year average for that month. The total for all grades of wood pulp for June was 313,259 net tons, while the corresponding figure for last year was but 189,389 tons.



PULP AND PAPER PRODUCTION, BY MONTHS, JANUARY, 1921, TO JUNE, 1922

According to recent news from Akron, July will stand out as the month of greatest tire production for that district. Over two and a half million tires were produced in Akron tire plants during the month, as compared with a total in May for the entire country of 2,722,000. In the preceding month the total output had been 2,421,000 tires. The imports of crude rubber during the first 5 months of the current year show an increase of 112.4 per cent over the receipts of the corresponding period in 1921.

Notwithstanding the several recent cuts in the price of crude oil as well as the accumulation of vast stocks of oil and of various petroleum products, production during June continued at an even greater rate than in the record month of March, 1922. The daily average reported by the Geological Survey was 1,508,233 bbl. for June and 1,504,323 bbl. for March. The total output in June, however, was about a million barrels less than in either March or May.

Other production and consumption statistics for the chemical and allied industries may be found in Table I. These are taken from the "Trend of Business Movements" section of the *Survey of Current Business* which is being compiled through the co-operative work of the Bureaus of Standards,

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	**152.08**
Last week	**153.56**
August, 1921	**158**
August, 1920	**264**
April, 1918 (high)	**286**
April, 1921 (low)	**140**

For over a month this index number has shown a consistent decline, having now fallen more than 8 points below the maximum of 160.49 reached during the week of May 24. This week's recession is traceable principally to the much lower prices for cottonseed and linseed oils.

TABLE I—THE TREND OF PRODUCTION IN CERTAIN OF THE CHEMICAL AND RELATED INDUSTRIES

Production of—	Feb., 1922	Mar., 1922	April, 1922	May, 1922	First 5 Months of 1921	First 5 Months of 1922	Percentage Increase or Decrease in 1922
Acetate of lime, thous. of lb....	7,942	11,134	7,836	7,107	25,088	42,513	+ 69.5
Alcohol (wood), gal..........	433,024	587,928	418,271	380,237	1,692,593	2,272,160	+ 34.2
Cement, thous. of bbl.........	4,278	6,685	9,243	11,176	33,172	35,673	+ 7.5
Coke, byproduct, thous. of short tons..............	1,795	2,137	2,227	2,537	9,047	10,599	+ 17.2
Coke, beehive, thous. of short tons..................	549	732	528	432	3,296	2,737	— 17.0
Cottonseed oil, thous. of lb....	91,321	72,237	27,610	12,389	607,092	304,263	— 49.9
Leather, sole, thous. of sides...	1,466	1,473	1,327	1,321	6,704	7,241	+ 8.0
Leather, finished upper, thous. of sq.ft..................	70,296	77,510	66,700	67,275	222,779	356,344	+ 60.0
Linseed oil*, thous. of lb......	6,647	7,232	6,069	7,952	38,294	34,357	— 10.3
Metals:							
Pig iron, thous. of long tons...	1,630	2,035	2,072	2,307	8,363	9,682	+ 15.8
Steel ingots, thous. of long tons..................	2,072	2,816	2,794	3,099	9,149	12,420	+ 35.8
Copper, thous. of lb..........	37,416	61,867	76,601	88,714	326,906	290,434	— 11.2
Zinc, thous. of lb............	45,026	53,064	51,012	54,838	188,004	251,352	+ 33.7
Paper and pulp:							
Wood pulp, chemical, sh. tons..................	144,568	170,995	147,608	167,197	659,138	666,318	+ 1.1
Newsprint, sh. tons..........	97,786	117,507	111,861	129,950	528,678	562,812	+ 6.5
All other paper, short tons....	404,031	475,353	528,461	589,971	2,075,218	2,720,304	+ 31.1
Petroleum:							
Crude oil, thous. of bbl.......	40,814	46,916	44,635	46,473	196,255	221,697	+ 13.0
Gasoline, thous. of gal........	398,223	472,228	472,920	513,659	2,032,050	2,291,703	+ 11.3
Kerosene, thous. of gal........	167,220	178,785	188,809	173,824	835,493	881,555	+ 5.3
Rubber:							
Crude‡, thous. of lb..........	18,467	26,771	43,407	35,727	124,332	264,105	+112.4
Pneumatic tires, thous........	2,084	2,646	2,401	2,722	6,439	11,908	+ 84.9
Sugar:							
Imports, raw, long tons.......	448,321	571,836	473,137	446,678	1,520,336	2,254,911	+ 48.3
Meltings, raw, long tons......	415,723	535,357	531,962	577,330	1,512,831	2,351,973	+ 55.5

* Shipments from Minneapolis. † Includes January and February only. ‡ Consumption by tire manuacturers.

Census and Foreign and Domestic Commerce. It is to be regretted that so few of the strictly chemical industries are represented in this worthwhile compilation. At present the wood chemical manufacturers are practically the only branch of the chemical industry whose production is reported by the Commerce Department.

As an important index of industrial progress it is of interest to note that of the twenty-three commodities included in Table I, nineteen showed increases over 1921. The only decreases were in the case of bee-hive coke, cottonseed and linseed oils and copper metal.

The New York Market

New York, Aug. 7, 1922.

The possibilities of an acute fuel shortage has doubtless been responsible for the much livelier interest which the chemical market has shown in many of the more basic commodities. In a few instances producers have already advanced their quotations, presumably in anticipation of fuel and transportation difficulties. An additional factor which has stimulated shipment business, especially among importers, has been the news from Washington that an agreement was likely to be reached on the tariff. In well-informed circles, however, it is generally believed that the tariff bill will not become a law much before Oct. 1.

Bichromates of potash and soda have shown appreciable increases during the interval and a much better inquiry was reported by several producers. Importers of powdered white arsenic have shown considerable firmness in their quotations, although domestic factors have not altered former prices. Copper sulphate continues along the same firm lines recently reported. Oxalic acid was in light supply on spot and several producers named higher prices for shipment. Caustic soda for export showed very little change, but domestic material was in steady demand for fair-sized quantities. Yellow prussiate of potash showed effects of renewed activity at slightly higher levels. Sulphate of ammonia remained in very light supply, with the export demand rather brisk. Zinc chloride prices were recorded at slightly lower levels and imported white granular sal ammoniac was considerably lower on spot, due to the recent importations.

General and Special Chemicals

Arsenic—A good inquiry was reported among resale merchants, with several fair-sized orders transacted at 8c. per lb. Domestic factors have not altered former prices of 7½c. The insecticide industry continues to show considerable activity.

Barium Chloride—Material was offered at \$85@\$90 per ton on spot, with shipments from abroad held around \$82 per ton. The demand has slackened noticeably.

Bichromate of Soda—Spot goods among resellers were higher at 7½@8c. per lb. Large producers have also advanced quotations and name 7½c. as a low figure. The fuel shortage and export demand are responsible for the advance.

Bichromate of Potash — Producers were quoting 10½c. per lb., showing an advance of 1c. per lb. Smaller lots are bringing as high as 11c. per lb. Fuel conditions are also the cause of the increase in this commodity.

Caustic Potash—Prices have shown very little change during the past few weeks. General conditions are rather quiet, with prices ranging around \$5.60 @\$6 per 100 lb.

Caustic Soda—There has been no unusual feature reported in the export market during the week. A few odd lots were sold around \$3.50 per 100 lb. f.a.s. Domestic goods were in moderate demand at \$3.75 per 100 lb., ex-store. Contracts remain quotably unchanged.

Fluoride of Soda—There has been keen competition among resellers, with sales recorded as low as 9c. per lb. Domestic factors quote the market at 9½c. per lb. The demand has been fairly active for small lots.

Formaldehyde—Small-quantity purchases featured the market during the past week, with sales heard around 8@8½c. per lb. Goods were not as freely offered as reported a few weeks ago and competition was less keen.

Glaubers Salt—Domestic producers continue to quote \$1.25 per 100 lb. in bags and \$1.40 in barrels. Imported goods in barrels brought as low as 95c. per 100 lb. The demand is rather dull at present.

Nickel Salts—Manufacturers have announced an advance of ½c. per lb. on the single variety, the present market for which is quoted around 12c. per lb. The double salt is held at around 11½c.

Oxalic Acid—A very firm tendency has been shown by this product during the interval, with prices ranging around 15c. per lb. f.o.b. works. Spot prices are quoted at 15½@16c. per lb.

Coal-Tar Products

The spot market for benzene was materially higher, although no change in former prices was reported. Water white solvent naphtha was reported higher among second hands and toluene, 90 per cent, was also much stronger on spot. Phenol is exceedingly scarce and dealers reported a very firm market. Technical beta naphthol has been offered rather freely of late, with prices fractionally lower, however.

Aniline Oil—Consumers have shown a better interest during the week and prices have been well maintained at 14@15c. per lb. Spot stocks are not as plentiful as recently reported.

Benzene—Spot supplies are very scarce and producers are finding difficulty to make regular contract deliveries. Contracts of the pure material were quoted at 30@35c. per gal. and 90 per cent at 27@32c. per gal. Dealers quote the resale market at 40@45c. per gal. for the 90 per cent.

Cresylic Acid—Consumers continue to send in a steady call for quantity shipments and the general market situation remains very firm. Sales of the 97-99 per cent for shipment were reported at 56@58c. per gal., with the 95-97 per cent at 51@53c. per gal. The spot resale market for 97-99 per cent held around 65c. per gal. and 62c. per gal. for the 95-97 per cent.

Phenol—There has been a very strong demand during the past few weeks, with the prime U.S.P. material in very scanty supply. A few odd lots were reported sold up to 17c. per lb. The general range is around 15@16c. per lb.

Hercules Earnings Four Times Those of 1921

For the 6 months ended June 30 the Hercules Powder Co. shows net earnings of $717,326. After subtracting charges, taxes and preferred dividends this is equivalent to $5.50 a share on the $7,150,000 common stock. This compares with earnings of $103,009, or $1.37 a share, for the corresponding period of 1921. This is shown in the following statement of income during the first half of each of the last 4 years:

	1922	1921	1920	1919
Gross receipts	$7,978,201	$6,537,615	$9,683,942	$12,173,831
Net earnings	717,326	103,009	1,265,285	488,420
Pref. dividends	324,051	253,154	190,582	187,250
Surplus	$393,275	$150,145 (a)	$1,074,703	$301,170

(a) Deficit.

The consolidated balance sheet on June 30, 1922, follows:

Assets	
Property and plants	$22,635,431
Cash	1,606,860
Accounts receivable	3,039,519
Collateral loans	2,028,019
Investment securities	1,874,676
Liberty bonds	1,172,239
Supplies	2,877,315
Finished products	1,950,105
Deferred charges	82,704
Contingent assets	146,268
Total	$37,413,136
Liabilities	
Common stock	$7,150,000
Preferred stock	8,112,900
Preferred stock in escrow	1,350,000
Aetna bonds	3,891,475
Bills payable	42,960
Accounts payable	293,266
Preferred dividends	82,800
Deferred credits	34,911
Federal taxes	88,898
Reserves	1,893,287
Contingent liabilities	146,268
Profit and loss surplus	14,326,371
Total	$37,413,136

Allied Chemical & Dye Active on Stock Market

Rumors that the dividend rate on the common stock of the Allied Chemical & Dye Corporation was shortly to be increased from $4 to $6 per year were largely responsible for sending this stock up to 74½ on Aug. 1. This was a new high for the year and is particularly significant, since it came in the face of the Senate's recent unfavorable action on the dye embargo.

No statement has been made by officials of the company regarding either dividends or earnings, but it is generally believed that current earnings after preferred dividends and taxes are at the rate of over $8 a share on outstanding common stock.

Air Reduction Co.'s Profits in Second Quarter, 1922

The operations of the Air Reduction Co., Inc., for the second quarter of 1922 show net profits of $231,351.25 before deduction is made for federal taxes. The gross income for the period was $1,773,882.89 and the operating expenses amounted to $1,235,004.67.

The operating income of $538,878.22 was divided between $270,585.72 of additions to reserves, $36,941.25 for paid and accrued bond and mortgage interest and the net profits referred to above. On the outstanding stock of 153,114 shares of no par value, the earnings are equivalent to $1.50 per share.

Exports of Chemicals

A special compilation of exports of domestic merchandise has been prepared by the Bureau of Foreign and Domestic Commerce for the Finance Committee of the Senate to use in connection with its study of the tariff. The report shows the value of all exports of chemicals to have been as follows:

1918	$165,239,860
1919	133,739,066
1920	168,999,706
1921	61,111,410

Exports to certain countries were as follows:

	1918	1920	1921
France	$35,624,663	$7,952,707	$2,740,229
Italy	13,687,087	5,336,540	603,273
England	24,819,739	19,759,556	8,888,363
Canada	26,682,349	20,790,637	11,989,648
Japan	16,643,052	21,943,000	5,238,540

Some of the totals for chemicals exported during 1920 and 1921 are as follows:

Article and	Unit	1920	1921
Carbolic acid,	lb.	2,151,475	249,658
Nitric acid,	lb.	716,914	177,580
Sulphuric acid,	lb.	28,987,342	12,814,344
Wood alcohol,	gal.	703,064	412,110
Calcium carbide,	lb.	23,369,534	11,808,252
Benzene,	lb.	13,174,268	72,030,400
Copper sulphate,	lb.	3,783,409	3,582,933
Aniline dyes,	dollars	22,450,480	5,067,000
Formaldehyde,	dollars	2,640,225	349,089
Glycerine,	lb.	1,742,708	2,394,714
Acetate of lime,	lb.	23,309,469	18,239,740
Chloride of lime,	lb.	48,826,348	18,447,579
Bicarb'nate of soda	lb.	20,642,201	11,703,183
Caustic soda,	lb.	224,137,406	49,865,219
Sal soda,	lb.	12,030,193	10,354,513
Silicate of soda,	lb.	34,095,542	20,789,095
Soda ash,	lb.	166,761,603	35,042,791
Borax,	lb.	14,325,037	4,061,633

Cottonseed Products During 1921 and 1922

Production, stocks and shipments of various cottonseed products for the 11 months' period ended June 30, 1921 and 1922, are compared in the following tabulation of the Census Bureau:

COTTONSEED PRODUCTS MANUFACTURED, SHIPPED OUT AND ON HAND

Item	Year	On Hand Aug. 1	Produced Aug. 1 to June 30	Shipped out Aug. 1 to June 30	On Hand June 30
Crude oil, lb.	1922	18,762,794*	922,790,186	922,739,461	12,193,691*
	1921	22,620,357	1,285,626,797	1,278,151,580	37,299,210
Refined oil, lb.	1922	228,263,633†	831,952,028‡	....	211,070,222†
	1921	297,741,580	1,129,147,699	....	299,617,782
Cake and meal, tons	1922	36,303	1,343,470	1,295,022	87,351
	1921	133,475	1,757,543	1,822,815	68,203
Hulls, tons	1922	73,280	927,832	958,323	42,789
	1921	18,304	1,234,573	1,164,021	88,856
Linters, 500-lb. bales	1922	124,377	394,004	449,760	68,621
	1921	176,316	434,239	456,333	154,222
Hull fiber, 500-lb. bales	1922	30,676	42,123	33,132	39,667
	1921	150,659	87,223	117,624	120,258

* Includes 4,346,848 and 1,272,420 lb. held by refining and manufcturing establishments and 5,507,880 and 1,962,480 lb. in transit to refiners and consumers Aug. 1 and June 30, respectively.

† Includes 5,884,495 and 4,229,584 lb. held by refiners, brokers, agents and warehousemen at places other than refineries and manufacturing establishments and 7,969,713 and 5,377,083 lb. in transit to manufacturers of lard substitute, oleomargarine, soap, etc., Aug. 1 and June 30, respectively.

‡ Produced from 903,708,168 lb. crude oil.

Export and Import Figures Show Trend of Chemical Business

Exports of chemicals and allied products declined from $10,424,794 in May to $8,662,326 in June. There was an increase as compared with exports in June of 1921, when the total value was $7,106,802. Exports of fertilizers in June were less than one-half those in May. Exports of explosives were only slightly more than one-third of those of May. Paints, pigments and varnishes almost held their own. Some comparisons between exports in June, 1922, with those of June, 1921, are as follows:

	1921	1922
Benzene, lb.	5,839,131	6,713,575
Carbolic acid, lb.	116,846	4,616
Acetic acid, lb.	817,159	2,481,290
Wood alcohol, gal.	24,036	63,937
Ammonium sulphate, lb.	261,725	217,282
Copper sulphate, lb.	55,020	291,273
Cyanide of soda, lb.	165,563	1,633,602
Soda ash, lb.	4,259,695	1,898,908
Caustic soda, lb.	3,239,833	11,355,908

Imports of chemicals on the free list during June were valued at $6,815,381. Imports of dutiable chemicals in June were valued at $4,429,532. While the imports of free-list chemicals show an increase of about $400,000 over those of June, 1921, there was a falling off of nearly $600,000 as compared with imports in May.

There was a decided upturn in the imports of dutiable chemicals, doubtless in anticipation of tariff legislation. The June imports of dutiable chemicals were nearly one million and a half dollars greater than those in May and exceeded those of June, 1921, by nearly $2,000,000.

The value of coal-tar products imported during June was $1,455,345, as compared with $817,364 in June of 1921. A comparison of other imports is given in the following table:

	1921	1922
Calcium acetate, etc., lb.	3,728,670	6,546,857
Quinine, oz.	70,700	132,360
Carbonate of potash, lb.	359,232	673,492
Cyanide of soda, lb.	3,295,887	519,958
Nitrate of soda, tons	37,847	49,442

As compared with last year, the greatest increases came in the gum group. More than $1,000,000 worth of gums was imported during June than in June of 1921. The imports of copal in June amounted to 3,597,596 lb. Receipts of gum arabic amounted to 1,338,286 lb. Actual camphor imports totaled 208,675 lb.

The St. Louis Market

ST. LOUIS, MO., Aug. 3, 1922.

Trading conditions in this market for chemicals have undergone no change since our last report. The market has felt very little effect of the coal shortage or transportation difficulties, but there is a tendency to rush shipments of some commodities in the hope of avoiding a tie-up should the situation become more serious. One of the outstanding features for the past 2 weeks has been the steadiness of prices in spite of the present unsettled situation. Business for the month of July has been much better than for the corresponding month of last year, and has by far exceeded the preceding month of June, with a continued broadening of inquiries indicating that confidence is again being restored.

ALKALIS

The market on alkalis has been very steady. No price changes have been reported and practically nothing except routine business is being done. *Soda ash* can be placed in the same classification with *caustic* in regard to price and volume of business. *Bicarbonate of soda* is moving fairly well and prices remain firm, with all dealers bringing their prices in line with the top market. *Sal soda* is moving rather slowly and jobbers are carrying very small stocks during the hot weather.

GENERAL AND SPECIAL CHEMICALS

Heavy mineral acids continue to move at the same rate. *Acetone* has again been advanced on account of the increase in *acetate of lime*, and is now being quoted at 13c. in carlots and 14½c. in less than carlots in drums, f.o.b. producers' works. Some of the leading producers of *acetic acid* have announced their new prices based on acetate of lime at $2.35 per 100 lb. This is the second advance in acetic acid as well as acetate of lime since the first of July. The demand for *citric acid* has been along quiet lines and the spot market is liberally supplied. Makers of *oxalic acid* are now quoting 16¾@17c. with a curtailment of supplies, and buyers are finding it difficult to locate spot goods. Supplies of *ammonia water*, 26 deg., are very large with an erratic demand. The market for *white arsenic, powdered*, is much stronger today than it was in our last report, prices now being quoted at 7½@7¾c. f.o.b. New York. The demand for *carbon bisulphide technical* has not eased since our last report and prices remain very firm. *Carbon tetrachloride* is moving in a routine way and is now being quoted at 9c. f.o.b. New York in large drums. *Glycerine* is steadily advancing and spot goods are now being held at 16c. per lb. There are no surplus stocks, the market being completely in the hands of producers. *Sulphur* has moved rather briskly due to consumers trying to anticipate the railroad strike. Prices did not change and business is again of normal volume. *Zinc sulphate* is still very strong at $2.85 per 100 lb. carlots f.o.b. St. Louis, and is keeping in line with the spelter market, which is now around $5.80 per 100 lb. with a further advance expected at any time.

VEGETABLE OILS AND NAVAL STORES

Turpentine is still the wild Indian of the naval stores. It has run prices up and down and is today anchored at $1.27 in single barrels, 6c. higher than when last reported. *Linseed oil* is running the usual course for this season. No contract business is being done, and only the necessary daily requirements are in demand. *Castor oil* remains firm and in good demand. Price is 13¼c. in drums for quantities of 200 gal., ½c. advance for less quantities. Further advances in castor would not come as a surprise.

PAINT MATERIAL

The month of August is a continuation of the dull period in the paint trade. Only routine buying is being done at present. Railroads are not buying and this curtails almost the entire business of several grinders in this district. Shipments of supplies are not coming through as they should and this too holds up operations.

The Iron and Steel Market

PITTSBURGH, Aug. 4, 1922.

Production of pig iron and steel has not decreased as much as was feared when railroad congestion due to the shopmen's strike increased the scarcity of coal. Production in July was approximately equal to production in May and June and thus was greater than in any earlier month of the year. As matters now stand, it is practically certain that production in August will show a great decline, but it does not follow that this will cause steel to become scarce. During the 4 months since the coal strike started there has been heavy production of steel, at a rate 20 per cent above the rate in the two biggest tonnage years before the war. In February, March and April it was commonly believed that part of the buying of steel was by way of insurance against a possible curtailment of production by the coal strike. If there was anything in that theory, steel consumers are more or less fortified. It is no small thing for the steel industry to run for 4 months at the rate of producing 36,000,000 tons of ingots a year. The two war years, 1917 and 1918, showed production between 43,000,000 and 44,000,000 tons, and the first 9 months of 1920, when consumption appeared to be very heavy, showed a rate of 42,000,000 tons.

STEEL INDUSTRY KEEPING AHEAD OF THE STRIKES

The fact that most buyers are pressing mills for better deliveries and the further fact that there is some inquiry for finished steel products for early delivery at premium prices are not conclusive that steel is going to become genuinely scarce. Consumers know that mills are well sold up ahead, and the individual consumer may be exerting pressure in fear that otherwise he may not receive his quota. The payment of delivery premiums involves only a relatively small tonnage. Finally, it is inconceivable that when the steel mills have been able to run so well during 4 months of the coal strike a fuel or transportation condition could arise that would greatly restrict the production of steel without also interfering very decidedly with the consumption of steel. The steel trade, taking it as a whole, possibly stands in less danger of steel becoming inconveniently scarce than it does of jobbers and manufacturing consumers being seized with a liquidating fever when coal and transportation conditions eventually begin to approach normal.

The turnover in steel products in the open market has become lighter still. The fact in itself is not significant, for the market is now in the middle of the midsummer period, always a dull one in steel. As to forward deliveries, the mills are not in position to sell, as they are already well sold up and farther ahead than they thought since production promises to be lighter than expected. While the mills would be unwilling to sell, buyers are unwilling to buy, and the habits of the market are too well known for anyone to expect buyers to become more willing to buy merely from seeing, later, that steel is more readily obtainable.

STEEL, IRON AND COKE PRICES

Basis prices, for deferred delivery, are substantially unchanged, at 1.70c. for bars, shapes, plates, 3.15c. for sheets, and so on, but the prices are in some cases more or less nominal, there being little trading.

For early deliveries limited tonnages are available at premiums ranging roughly speaking from $2 to $5 a ton. The demand is rather limited in point of tonnage, but the balance is somewhat in favor of sellers, so that delivery premiums show a slight tendency to increase.

The coal market means little to the iron and steel industry, prices being high while tonnages available are limited. Connellsville steam coal reached a new high point of $8.50 on Wednesday, July 26, and then reacted sharply to $6 Tuesday morning, Aug. 1, by reason of withdrawal of buyers. On the reappearance of buyers the market has since advanced to $7. Connellsville coke, which is so scarce and at such high prices as to interest practically no consumers but foundries, advanced to $15.50 for foundry grade at the beginning of this week, having since softened a trifle.

Merchant production of pig iron has decreased greatly and is now quite light. There are some stocks at furnaces and some consumers have very fair stocks, while it appears that consumption has been decreasing. Offerings are very limited, as is also demand, but the latter preponderates and prices have been rising.

General Chemicals

Current Wholesale Prices in New York Market

		Carlots F.o.b. N.Y.	Less Carlots F.o.b. N.Y.
Acetic anhydride	lb.	..... –	$0.38 – $0.40
Acetone	lb.	$0.13½ – $0.13¾	.14 – .14½
Acid, acetic, 28 per cent	100 lbs.	2.60 – 2.65	2.70 – 3.25
Acetic, 56 per cent	100 lbs.	5.25 – 5.35	5.40 – 5.75
Acetic, glacial, 99½ per cent, carboys	100 lbs.	11.50 – 12.00	12.25 – 12.50
Boric, crystals	lb.	.11 – .11½	.11¾ – .12
Boric, powder	lb.	.11 – .11½	.11¾ – .12½
Citric	lb.	..... –	.45 – .45½
Hydrochloric	100 lb.	1.10 – 1.20	1.25 – 1.70
Hydrofluoric, 52 per cent	lb.	.11 – .11½	.11½ – .12
Lactic, 44 per cent tech	lb.	.09½ – .10	.10½ – .12
Lactic, 22 per cent tech	lb.	.04 – .04½	.04½ – .05
Molybdic, c.p.	lb.	3.00 – 3.25	3.30 – 3.75
Muriatic, 20 deg. (see hydrochloric)		..... –	..... – .....
Nitric, 40 deg.	lb.	.06 – .06½	.06½ – .07
Nitric, 42 deg.	lb.	.06½ – .06¾	.07 – .07½
Oxalic, crystals	lb.	.15½ – .16	.16½ – .16½
Phosphoric, 50 per cent solution	lb.	.08 – .08½	.08½ – .09½
Picric	lb.	.20 – .22	.23 – .27
Pyrogallic, resublimed	lb.	..... –	1.65 – 1.75
Sulphuric, 60 deg., tank cars	ton	9.50 – 10.00	..... – .....
Sulphuric, 60 deg., drums	ton	12.00 – 14.00	..... – .....
Sulphuric, 66 deg., tank cars	ton	14.50 – 15.00	..... – .....
Sulphuric, 66 deg., drums	ton	19.00 – 20.00	20.50 – 21.00
Sulphuric, 66 deg., carboys	ton	..... –	..... – .....
Sulphuric, fuming, 20 per cent (oleum) tank cars	ton	19.00 – 20.00	..... – .....
Sulphuric, fuming, 20 per cent (oleum) drums	ton	22.00 – 22.50	23.00 – 24.00
Sulphuric, fuming, 20 per cent (oleum) carboys	ton	31.00 – 32.00	33.00 – 34.00
Tannic, U. S. P.	lb.	..... –	.60 – .75
Tannic (tech.)	lb.	.40 – .45	.46 – .50
Tartaric, imported crystals	lb.	..... –	.28½ – .29
Tartaric acid, imported, powdered	lb.	..... –	.29 – .30
Tartaric acid, domestic	lb.	..... –	..... – .30
Tungstic, per lb. of WO	lb.	..... –	1.00 – 1.10
Alcohol, ethyl (Cologne spirit)	gal.	..... –	4.75 – 4.95
Alcohol, methyl (see methanol)		..... –	..... – .....
Alcohol, denatured, 188 proof No. 1	gal.	..... –	.31 – .33
Alcohol, denatured, 188 proof No. 5	gal.	..... –	.31 – .33
Alum, ammonia, lump	lb.	.03½ – .03¾	.03¾ – .04
Alum, potash, lump	lb.	.03 – .03½	.03½ – .04
Alum, chrome lump	lb.	.05 – .05½	.05½ – .06
Aluminum sulphate, commercial	100 lb.	1.50 – 1.65	1.70 – 2.25
Aluminum sulphate, iron free	lb.	.02½ – .02¾	.03 – .03½
Aqua ammonia, 26 deg., drums (750 lb.)	lb.	.06½ – .07½	.07½ – .08
Ammonia, anhydrous, cyl. (100-150 lb.)	lb.	.30 – .30½	.30½ – .31
Ammonium carbonate, powder	lb.	.08½ – .08½	.08½ – .09
Ammonium nitrate	lb.	.06 – .06½	.06½ – .07½
Amylacetate tech.	gal.	..... –	2.00 – 2.25
Arsenic, white, powdered	lb.	.07¾ – .08	.08½ – .08½
Arsenic, red, powdered	lb.	.12 – .12½	.12½ – .13
Barium carbonate	ton	60.00 – 62.00	63.00 – 66.00
Barium chloride	ton	85.00 – 90.00	91.00 – 100.00
Barium dioxide (peroxide)	lb.	.20 – .21	.21½ – .22
Barium nitrate	lb.	.07½ – .07¾	.08 – .08½
Barium sulphate (precip.) (blanc fixe)	lb.	.04 – .04½	.04½ – .04¾
Blanc fixe, dry	lb.	.04 – .04½	..... – .....
Blanc fixe, pulp	ton	45.00 – 55.00	..... – .....
Bleaching powder	100 lb.	1.60 – 1.75	1.85 – 2.50
Blue vitriol (see copper sulphate)		..... –	..... – .....
Borax	lb.	.05½ – .05¾	.06 – .06½
Brimstone (see sulphur, roll)		..... –	..... – .....
Bromine	lb.	.27 – .28	.28½ – .35
Calcium acetate	100 lbs.	2.35 – 2.40	2.45 – 2.50
Calcium carbide	lb.	.04½ – .04¾	.05 – .05½
Calcium chloride, fused, lump	ton	22.00 – 23.00	23.50 – 27.00
Calcium chloride, granulated	lb.	.01½ – .01¾	.02 – .02½
Calcium peroxide	lb.	..... –	1.40 – 1.50
Calcium phosphate, tribasic	lb.	..... –	.15 – .16
Camphor	lb.	..... –	.81 – .83
Carbon bisulphide	lb.	.06½ – .06¾	.07 – .07½
Carbon tetrachloride, drums	lb.	.09½ – .10	.10½ – .12
Carbonyl chloride, (phosgene)	lb.	..... –	.60 – .75
Caustic potash (see potassium hydroxide)		..... –	..... – .....
Caustic soda (see sodium hydroxide)		..... –	..... – .....
Chalk, precip.—domestic, light	lb.	.04½ – .04½	..... – .....
Chalk, precip.—domestic, heavy	lb.	.03½ – .03¾	..... – .....
Chalk, precip.—imported, light	lb.	.04½ – .05	..... – .....
Chlorine, gas, liquid-cylinders (100 lb.)	lb.	.05 – .05½	.05½ – .06
Chloroform	lb.	..... –	.25 – .32
Cobalt oxide	lb.	..... –	2.00 – 2.10
Copperas	ton	20.00 – 22.00	23.00 – 30.00
Copper carbonate, green precipitate	lb.	.19 – .20	.20½ – .21
Copper cyanide	lb.	..... –	.58 – .60
Copper sulphate, crystals	100 lb.	6.50 – 6.60	6.65 – 7.00
Cream of tartar	lb.	..... –	.23 – .25
Epsom salt (see magnesium sulphate)		..... –	..... – .....
Ethyl acetate com. 85%	gal.	..... –	.65 – .70
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	..... –	.90 – .95
Formaldehyde, 40 per cent	lb.	.08 – .08½	.08½ – .09
Fullers earth, f.o.b. mines	net ton	16.00 – 17.00	..... – .....
Fullers earth—imported powdered—net	ton	30.00 – 32.00	..... – .....
Fusel oil, ref.	gal.	..... –	2.25 – 2.65
Fusel oil, crude	gal.	..... –	1.45 – 1.50
Glauber's salt (see sodium sulphate)		..... –	.16½ – .17
Glycerine, c. p. drums extra	lb.	..... –	.15½ – .15¾
Iodine, resublimed	lb.	..... –	4.20 – 4.25
Iron oxide, red	lb.	..... –	.12 – .18
Lead acetate, white crystals	lb.	..... –	.10½ – .11½
Lead arsenate, powd.	lb.	.13 – .13½	.13½ – .14½
Lead nitrate	lb.	..... –	.15 – .20
Litharge	lb.	.07½ – .08	.08½ – .09
Magnesium carbonate, technical	lb.	.06 – .06½	.06½ – .07½
Magnesium sulphate, U. S. P.	100 lb.	2.00 – 2.25	2.30 – 2.50
Magnesium sulphate, technical	100 lb.	..... –	1.00 – 1.80
Methanol, 95%	gal.	..... –	.57 – .58
Methanol, 97%	gal.	..... –	.59 – .60
Nickel salt, double	lb.	..... –	.11 – .11½
Nickel salt, single	lb.	..... –	.12 – .12½
Phogene (see carbonyl chloride)		..... –	..... – .....
Phosphorus, red	lb.	..... –	.40 – .45
Phosphorus, yellow	lb.	..... –	.30 – .35
Potassium bichromate	lb.	.10½ – .10¾	.11 – .11½
Potassium bromide, granular	lb.	..... –	.17 – .23
Potassium carbonate, U. S. P.	lb.	.12 – .12½	.13 – .16
Potassium carbonate, 80-85%	lb.	.05 – .05½	.05½ – .06
Potassium chlorate, powdered and crystals	lb.	.06½ – .07	.07½ – .08
Potassium cyanide	lb.	..... –	.55 – .57
Potassium hydroxide (caustic potash)	100 lb.	5.60 – 6.00	6.10 – 6.25
Potassium iodide	lb.	..... –	3.20 – 3.35
Potassium nitrate	lb.	.06½ – .06¾	.07 – .08
Potassium permanganate	lb.	.13 – .13½	.14 – .15
Potassium prussiate, red	lb.	..... –	.90 – .95
Potassium prussiate, yellow	lb.	.32 – .32½	.32½ – .33
Rochelle salts (see sodium potas. tartrate)		..... –	..... – .....
Salammoniac, white, granular	lb.	.06½ – .06½	.06½ – .07½
Salammoniac, gray, granular	lb.	.07¾ – .08	.08½ – .08½
Salsoda	100 lb.	1.20 – 1.40	1.45 – 1.60
Salt cake (bulk)	ton	19.00 – 22.00	..... – .....
Soda ash, light, 58 per cent flat, bags, contract	100 lb.	1.60 – 1.67	2.00 – 2.25
Soda ash, light, 58 per cent flat, bags, resale	100 lb.	1.75 – 1.80	1.85 – 2.35
Soda ash, dense, in bags, resale	100 lb.	1.85 – 1.90	1.95 – 2.40
Sodium acetate	lb.	.06½ – .06¾	.07 – .07½
Sodium bicarbonate	100 lb.	1.75 – 1.85	1.90 – 2.30
Sodium bichromate	lb.	.07½ – .07¾	.08 – .08½
Sodium bisulphate (nitre cake)	ton	4.50 – 4.60	4.65 – 5.50
Sodium bisulphite powdered, U.S.P.	lb.	.04½ – .04½	.04½ – .05½
Sodium chlorate	lb.	.06½ – .06¾	.07 – .07½
Sodium chloride	long ton	12.00 – 13.00	..... – .....
Sodium cyanide	lb.	.20 – .21	.22 – .25
Sodium fluoride	lb.	.09½ – .10	.10½ – .10½
Sodium hydroxide (caustic soda) solid, 76 per cent flat, drums, contract	100 lb.	3.35 – 3.40	3.75 – 4.00
Sodium hydroxide (caustic soda) solid, 76% flat, drums, resale	100 lb.	3.50 – 3.55	3.60 – 4.00
Sodium hydroxide (caustic soda), ground and flake, contracts	100 lb.	3.80 – 3.90	4.25 – 4.40
Sodium hydroxide (caustic soda) ground and flake, resale	100 lb.	4.00 – 4.15	4.40 – 4.60
Sodium hyposulphite	lb.	.02½ – .03	.03½ – .03½
Sodium nitrite	lb.	.07½ – .08	.08½ – .08¾
Sodium peroxide, powdered	lb.	.28 – .30	.31 – .35
Sodium phosphate, dibasic	lb.	.03½ – .04	.04½ – .04½
Sodium potassium tartrate (Rochelle salts)	lb.	..... –	.18 – .21
Sodium prussiate, yellow	lb.	.20½ – .21	.21½ – .21½
Sodium silicate, (40 deg. in drums)	100 lb.	.80 – 1.00	1.05 – 1.25
Sodium silicate, (60 deg. in drums)	100 lb.	2.25 – 2.40	2.45 – 2.75
Sodium sulphate, crystals (glaubers salt)	100 lbs.	.90 – 1.00	1.05 – 1.50
Sodium sulphide, fused, 60-62 per cent (conc.)	lb.	.04 – .04½	.04½ – .05
Sodium sulphite, crystals	lb.	.03½ – .03¾	.03¾ – .04½
Strontium nitrate, powdered	lb.	.09½ – .10	.10½ – .12
Sulphur chloride, yellow	lb.	.04½ – .05	.05½ – .06
Sulphur, crude	ton	18.00 – 20.00	..... – .....
Sulphur dioxide, liquid, cylinders extra	lb.	.08 – .08½	.09 – .10
Sulphur (sublimed), flour	100 lb.	..... –	2.25 – 3.10
Sulphur, roll (brimstone)	100 lb.	2.00 – 2.15	2.20 – 2.70
Talc—imported	ton	30.00 – 40.00	..... – .....
Talc—domestic powdered	ton	18.00 – 25.00	..... – .....
Tin bichloride	lb.	.09 – .09½	.09½ – .10
Tin oxide	lb.	..... –	.35 – .37
Zinc carbonate	lb.	.14 – .14½	.14½ – .15½
Zinc chloride, gran.	lb.	.5½ – .06	.06½ – .06¾
Zinc cyanide	lb.	.42 – .44	.45 – .47
Zinc oxide, XX	lb.	.07½ – .08	.08½ – .08½
Zinc sulphate	100 lb.	2.75 – 3.00	3.05 – 3.30

Coal-Tar Products

NOTE—These prices are for original packages in large quantities f.o.b. N.Y.:

Alpha-naphthol, crude	lb.	$1.00 — $1.05
Alpha-naphthol, refined	lb.	1.10 — 1.15
Alpha-naphthylamine	lb.	.28 — .30
Aniline oil, drums extra	lb.	.14 — .16
Aniline salts	lb.	.22 — .24
Anthracene, 80% in drums (100 lb.)	lb.	.75 — 1.00
Benzaldehyde U.S.P.	lb.	1.25 — 1.30
Benzene, pure, water-white, in drums (100 gal.)	gal.	.30 — .35
Benzene, 90%, in drums (100 gal.)	gal.	.28 — .32
Benzidine, base	lb.	.85 — .95
Benzidine sulphate	lb	.80 — .85
Benzoic acid, U.S.P.	lb.	.65 — .67
Benzoate of soda, U.S.P.	lb.	.53 — .55
Benzyl chloride, 95-97%, refined	lb.	.25 — .27
Benzyl chloride, tech.	lb.	.20 — .23
Beta-naphthol benzoate	lb.	3.75 — 4.00
Beta-naphthol, sublimed	lb.	.50 — .55
Beta-naphthol, tech	lb.	.22 — .25
Beta-naphthylamine, sublimed	lb.	1.50 — 1.60
Carbazol	lb.	.75 — .90
Cresol, U. S. P., in drums (100 lb.)	lb.	.12 — .15
Ortho-cresol, in drums (100 lb.)	lb.	.16 — .18
Cresylic acid, 97-99%, straw color, in drums	gal.	.56 — .65
Cresylic acid, 95-97%, dark, in drums	gal.	.51 — .58
Dichlorbenzene	lb.	.06 — .09
Diethylaniline	lb.	.65 — .70
Dimethylaniline	lb.	.36 — .38
Dinitrobenzene	lb.	.20 — .22
Dinitroclorbenzene	lb.	.21 — .22
Dinitronaphthalene	lb.	.30 — .32
Dinitrophenol	lb.	.33 — .35
Dinitrotoluene	lb.	.22 — .24
Dip oil, 25%, car lots, in drums	gal.	.24 — .26
Diphenylamine	lb.	.55 — .58
H-acid	lb.	.85 — .95
Meta-phenylenediamine	lb.	.85 — 1.00
Monochlorbenzene	lb.	.10 — .11
Monoethylaniline	lb.	1.00 — 1.20
Naphthalene crushed, in bbls.	lb.	.06 — .06½
Naphthalene, flake	lb.	.06½ — .07
Naphthalene, balls	lb.	.07½ — .08
Naphthionate of soda	lb.	.58 — .65
Naphthionic acid, crude	lb.	.65 — .70
Nitrobenzene	lb.	.10 — .12
Nitro-naphthalene	lb.	.30 — .35

Nitro-toluene	lb.	$0.15 —	$0.17
N-W acid	lb.	1.15 —	1.30
Ortho-amidophenol	lb.	2.10 —	2.15
Ortho-dichlor-benzene	lb.	.17 —	.20
Ortho-nitro-phenol	lb.	.75 —	.77
Ortho-nitro-toluene	lb.	.10 —	.13
Ortho-toluidine	lb.	.12 —	.14
Para-amidophenol, base	lb.	1.30 —	1.35
Para-amidophenol, HCl	lb.	1.35 —	1.40
Para-dichlorbenzene	lb.	.17 —	.20
Paranitroaniline	lb.	.72 —	.80
Para-nitrotoluene	lb.	.55 —	.65
Para-phenylenediamine	lb.	1.55 —	1.60
Para-toluidine	lb.	.85 —	.90
Phthalic anhydride	lb.	.35 —	.38
Phenol, U. S. P., drums	lb.	.15 —	.15½
Pyridine	gal.	1.75 —	2.75
Resorcinol, technical	lb.	1.30 —	1.35
Resorcinol, pure	lb.	1.75 —	1.80
R-salt	lb.	.55 —	.60
Salicylic acid, tech., in bbls	lb.	.23 —	.24
Salicylic acid, U. S. P	lb.	.25 —	.26
Solvent naphtha, water-white, in drums, 100 gal	gal.	.27 —	.32
Solvent naphtha, crude, heavy, in drums, 100 gal	gal.	.14 —	.18
Sulphanilic acid, crude	lb.	.24 —	.26
Tolidine	lb.	1.20 —	1.30
Toluidine, mixed	lb.	.30 —	.35
Toluene, in tank cars	gal.	.25 —	.28
Toluene, in drums	gal.	.30 —	.35
Xylidines, drums, 100 gal	lb.	.40 —	.45
Xylene, pure, in drums	gal.	.40 —	.45
Xylene, pure, in tank cars	gal.	.45 —	....
Xylene, commercial, in drums, 100 gal	gal.	.33 —	.35
Xylene, commercial, in tank cars	gal.	.30 —	....

Waxes

Prices based on original packages in large quantities f.o.b. N.Y.

Bayberry Wax	lb.	$0.20 —	$0.21
Beeswax, refined, dark	lb.	.30 —	.32
Beeswax, refined, light	lb.	.34 —	.35
Beeswax, pure white	lb.	.38 —	.42
Candellila, wax	lb.	.38 —	.40
Carnauba, No. 1	lb.	.40 —	.42
Carnauba No. 2, North Country	lb.	.24 —	.25
Carnauba, No. 3, North Country	lb.	.17 —	.17½
Japan	lb.	.16½ —	.17
Montan, crude	lb.	.03¾ —	.04
Paraffine waxes, crude match wax (white) 105-110 m.p.	lb.	.04¼ —	....
Paraffine waxes, crude, scale 124-126 m.p.	lb.	.02¾ —	....
Paraffine waxes, refined, 118-120 m.p.	lb.	.03¼ —	.03½
Paraffine waxes, refined, 125 m.p.	lb.	.03¾ —	.03¾
Paraffine waxes, refined, 128-130 m.p.	lb.	.04 —	.04¼
Paraffine waxes, refined, 133-135 m.p.	lb.	.04½ —	.04¾
Paraffine waxes, refined, 135-137 m.p.	lb.	.05 —	.05¼
Stearic acid, single pressed	lb.	.09 —	.09½
Stearic acid, double pressed	lb.	.09½ —	.09¾
Stearic acid, triple pressed	lb.	.10¼ —	.10¾

Naval Stores

All prices are f.o.b. New York unless otherwise stated, and are based on carload lots. The oils in 50 gal. bbls., gross weight, 500 lb.

Rosin B-D, bbl	280 lb.	$5.75 —	$6.20
Rosin E-I	280 lb.	6.25 —	6.65
Rosin K-N	280 lb.	6.70 —	7.80
Rosin W. G.-W. W	280 lb.	7.85 —	8.40
Wood rosin, bbl	280 lb.	6.25 —	.....
Spirits of turpentine	gal.	1.16 —	1.17
Wood turpentine, steam dist	gal.	.85 —	.....
Wood turpentine, dest. dist	gal.	.70 —	.70
Pine tar pitch, bbl	200 lb.	...... —	6.00
Tar, kiln burned, bbl. (500 lb.)	bbl.	...... —	9.50
Retort tar, bbl	500 lb	—	9.00
Rosin oil, first run	gal.	.36 —	.....
Rosin oil, second run	gal.	.38 —	.....
Rosin oil, third run	gal.	.46 —	.....
Pine oil, steam dist., sp.gr., 0.930-0.940	gal.		1.00
Pine oil, pure, dest. dist	gal.		.95
Pine tar oil, ref., sp.gr. 1.025-1.035	gal.		.46
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla	gal.		.35
Pine tar oil, double ref., sp.gr. 0.965-0.990	gal.		.75
Pine tar, ref., thin, sp.gr., 1.080-1.960	gal.		.25
Hardwood oil, f.o.b. Mich., sp.gr., 0.960-0.990	gal.		.25
Pinewood creosote, ref	gal.		.52

Fertilizers

Prices Remain Quotably Unchanged

Crude Rubber

Quotations Remain Same as Previous Report

Oils

VEGETABLE

The following prices are f.o.b. New York for carload lots.

Castor oil, No. 3, in bbls	lb.	$0.12 —	$0.12½
Castor oil, AA, in bbls	lb.	.12½ —	.13
China wood oil, in bbls	lb.	.12¼ —	.12½
Coconut oil, Ceylon grade, in bbls	lb.	.08½ —	.08¾
Coconut oil, Cochin grade, in bbls	lb.	.09 —	.09½
Corn oil, crude, in bbls	lb.	.10½ —	.10¾
Cottonseed oil, crude (f. o. b. mill)	lb.	.08¾ —	.09
Cottonseed oil, summer yellow	lb.	.10¾ —	.11
Cottonseed oil, winter yellow	lb.	.11½ —	.12
Linseed oil, raw, car lots (domestic)	gal.	.85 —	.86
Linseed oil, raw, tank cars (domestic)	gal.	.80 —	.81
Linseed oil, boiled, in 5-bbl lots (domestic)	gal.	.87 —	.88
Olive oil, denatured	gal.	1.15 —	1.17
Palm, Lagos	lb.	.07 —	.07½
Palm, Niger	lb.	.06½ —	.06¾
Peanut oil, crude, tank cars (f.o.b. mill)	lb.	.09 —	.09½
Peanut oil, refined, in bbls	lb.	.12 —	.12½
Rapeseed oil, refined in bbls	gal.	.82 —	.83
Rapeseed oil, blown, in bbls	gal.	.88 —	.89
Soya bean oil (Manchurian), in bbls. N. Y.	lb.	.11½ —	....
Soya bean oil, tank cars, f.o.b., Pacific coast	lb.	.09½ —	....

FISH

Light pressed menhaden	gal.	$0.51 —	....
Yellow bleached menhaden	gal.	.53 —	.54
White bleached menhaden	gal.	.55 —	.56
Blown menhaden	gal.	.61 —	....
Whale Oil, No. 1. crude, tanks, coast	gal.	.45 —	.48

Miscellaneous Materials

Shellac, orange fine	lb.	.75 —	.76
Shellac, orange superfine	lb.	.77 —	.78
Shellac, A. C. garnet	lb.	.68 —	.69
Shellac, T. N.	lb.	.72 —	.73

Other Prices Same as Previous Report

Refractories

All Quotations Remain Unchanged

Ferro-Alloys

All Prices Same as Report of July 31

Ores and Semi-finished Products

All f.o.b. New York Unless Otherwise Stated

Bauxite, domestic, crushed and dried	net ton	$6.00 —	$9.00
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	19.00 —	21.00
Chrome ore, 50% Cr_2O_3, f.o.b. Atlantic seaboard	ton	18.00 —	21.00
Coke, foundry, f.o.b. ovens	net ton	14.50 —	....
Coke, furnace, f.o.b. ovens	net ton	14.00 —	.....
Fluorspar, gravel, f.o.b. mines, New Mexico	net ton	15.00 —	.....
Fluorspar, standard, domestic washed gravel Kentucky and Illinois mines	net ton	17.50 —	19.00
Ilmenite, 52% TiO_2, per lb. ore	lb.	.01½ —	.01½
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.28½ —	.29
Manganese ore, chemical (MnO_2)	net ton	60.00 —	65.00
Molybdenite, 85% MoS_2, per lb. of MoS_2, N. Y.	lb.	.45 —	.50
Monazite, per unit of ThO_2, c.i.f., Atlantic seaport.	unit	27.00 —	......
Pyrites, Spanish, fines, c.i.f., Atlantic seaport	unit	.10½ —	.11
Pyrites, Spanish, furnace size, c.i.f. Atlantic seaport	unit	.12 —	.13½
Pyrites, domestic, fines, f.o.b. mines, Ga.	unit	Nominal	
Rutile, 95% TiO_2 per lb. ore	lb.	.12 —	.....
Tungsten, scheelite, 60% WO_3 and over, per unit of WO_3 (nominal)	unit	3.00 —	3.25
Tungsten, wolframite, 60% WO_3 and over, per unit of WO_3, N. Y. C.	unit	3.25 —	3.50
Uranium ore (carnotite) per lb. of U_3O_8	lb.	1.25 —	1.75
Uranium oxide, 96% per lb. contained U_3O_8	lb.	2.25 —	2.50
Vanadium pentoxide, 99%	lb.	12.00 —	14.00
Vanadium ore, per lb. of V_2O_5 contained	lb.	1.00 —	.....
Zircon, washed, iron free, f.o.b. Pablo, Florida	lb.	04½ —	.13½

Non-Ferrous Metals

All f.o.b. New York Unless Otherwise Stated

	Cents per Lb
Copper, electrolytic	13.975-14.00
Aluminum, 98 to 99 per cent	18.00-19.00
Antimony, wholesale lots, Chinese and Japanese	5.25
Nickel, ordinary (ingot)	36.00
Nickel, electrolytic	39.00
Nickel, electrolytic, resale	32.00-33.00
Nickel, ingot and shot, resale	30.00-31.00
Monel metal, shot and blocks	32.00
Monel metal, ingots	35.00
Monel metal, sheet bars	38.00
Tin, 5-ton lots, Straits	32.25
Lead, New York, spot	5.75-5.80
Lead, E. St. Louis, spot	5.45-5.475
Zinc, spot, New York	6.60-6.65
Zinc, spot, E. St. Louis	6.20-6.25

OTHER METALS

Silver (commercial)	oz.	$0.69½
Cadmium	lb.	1.20-1.25
Bismuth (500 lb. lots)	lb.	2.00@2.10
Cobalt	lb.	3.00@3.25
Magnesium, ingots, 99 per cent	lb.	1.15@1.25
Platinum	oz.	90.00
Iridium	oz.	180.00@185.00
Palladium	oz.	55.00
Mercury	75 lb.	55.00

Industrial

Financial, Construction and Manufacturers' News

Industrial Developments

PAPER—The Chesapeake Paper Board Co., Baltimore, Md., has placed its plant on the Key Highway on a maximum production basis, under 24-hour operation, giving employment to a full working force. The output is averaging about 60,000 lb. of material per day.

The Clarion Paper Co., Johnsonburg, Pa., is operating its local mill on a full production basis, giving employment to a regular working force.

The International Paper Co., New York, N. Y., is increasing production at its newsprint plants, and is now averaging in excess of its normal rated capacity of 1,300 tons per day. It is expected to maintain operations at close to this basis.

OIL—The Midcontinent Producing & Refining Corp. is perfecting plans for the resumption of operations at its oil refinery at Greenville, Tex., comprising the former plant of the North Texas Oil & Refining Co., recently acquired. Improvements will be made in the refinery, and regular working force employed.

The oil refinery of the Beaver Electra Refining Co., Electra, near Wichita Falls, Tex., will be placed in operation by the new owners, D. E. DeCourse and associates, who recently purchased the plant. It is expected to develop normal capacity at an early date. Improvements are being made.

The Pure Oil Co. and the Humphreys Oil Co., Mexia, Tex., affiliated, are increasing production at their local properties.

IRON AND STEEL—The Iron Products Corp., Birmingham, Ala., is operating full at all its plants with the exception of the blast furnace at Holt, Ala.; it is expected to blow in this unit during the present month.

The Crucible Steel Co. is increasing production at its plant at Syracuse, N. Y. The works have been on a curtailed operating basis for about 18 months past. Other plants of the company are also advancing their outputs, including the works at Pittsburgh, Pa., and Harrison, N. J., and it is expected to operate at normal at an early date.

Coal shortage and the railroad strike have been responsible for the partial shutdown of a number of steel mills during the past week, as well as the banking of certain blast furnaces, as follows: The A. M. Byers Co., Pittsburgh, Pa., has curtailed operations at 21 puddling furnaces at Girard, O.; the Briar Hill Steel Co., Youngstown, O., has banked a second furnace, leaving but one active unit at the works; the Fort Wayne Rolling Mills, Fort Wayne, Ind., has closed its plant for an indefinite period; the American Sheet & Tin Plate Co., Youngstown, O., has shut down temporarily 26 tin mills, with expectation of resuming at an early date; the Buffalo-Union Furnace Co., Buffalo, N. Y., has banked one of its furnaces, and the Doner Steel Co., in the same district, has also closed down a blast furnace at its works; the Follansbee Brothers Co., Pittsburgh, Pa., has closed down its sheet and tinplate mills temporarily at Steubenville, O., and Follansbee, W. Va., affecting about 2,000 men; the American Sheet & Tinplate Co., a subsidiary of the United States Steel Corp., has curtailed operations at a number of hot mills at its Farrell, Pa., works, with plans for resumption in the immediate future; the Shenango Furnace Co. has banked its furnace at Sharpsville, Pa.

In order to insure continuous operations at its steel mills the Central Iron & Steel Co., Harrisburg, Pa., has discontinued the use of coal as fuel at two of its open-hearth furnaces, and is now running on oil.

The Gulf States Steel Co., Birmingham, Ala., has all departments of its works in full operation, and is planning to increase production immediately at its finishing mills.

MISCELLANEOUS—The Stonecreek Brick Co., Stonecreek, O., has commenced operations at its local plant with all 8 kilns ready for service, on a working basis of 50,000 bricks per day.

The American Window Glass Co. has commenced preliminary operations at the No. 1 tank at its Kane, Pa., works; the No. 2 tank is in full operation and it is proposed to have the entire plant running at capacity before the close of the month. About 200 men will be added to the working force. The Interstate Window Glass Co., at this same place, is making ready to resume operations at its plant after a shutdown for about 90 days, and will give employment to about 250 operatives.

Owing to fuel shortage the Giant Portland Cement Co. has closed down temporarily its Central mill at Copley, Pa. Unless there is a change in the situation the company will soon curtail production at its Reliance mill in this same district.

The Summit Solvay Co., Birmingham, Ala., has placed its final battery of coke ovens in operation, making 240 ovens now in service, or full plant capacity. It is expected to operate on this basis for an indefinite period.

The American Brass Co., Waterbury, Conn., is increasing operations at its local mills, and is now consuming at the rate of more than 800,000 lb. of copper per day. The company is a subsidiary of the Anaconda Copper Mining Co.

The National Sulphur Co., Akron, O., is arranging for the immediate operation of its local plant and will recruit a working force of about 250 men.

The W. D. Byron & Sons Leather Co., Williamsport, Md., is running its local tannery at full capacity in all departments. A number of extensions will be made in the plant at an early date.

The Continental Leather Co., Wissimoming, Philadelphia, Pa., is maintaining active operations at good capacity at its local tannery.

Construction and Operation

California

OAKDALE—The Pacific Asbestos Corp., operating mining properties in this section, has preliminary plans under way for the construction of a new plant. Plans will be prepared at an early date. The company has recently been acquired by new interests headed by W. A. Sutherland, president of the Fidelity Trust & Savings Bank, Fresno.

LINDSAY—The Big Fertilizer Co. is negotiating with the local Chamber of Commerce relative to a site for the construction of a new plant for the manufacture of commercial fertilizer products. The initial works will cost about $25,000. George W. Abel is president of the company; A. M. Robertson, secretary of the Chamber of Commerce, is in charge of local details of the project.

MARYSVILLE—Local interests have organized a new company to construct and operate a plant for the manufacture of brick and other burned clay products. The initial works will have a capacity of about 10,000 bricks per day. Machinery will be purchased and operations placed under way at an early date. The company is headed by officials of the Shasta Lumber Co. and the Union Lumber Co.; L. E. Hite, L. A. Williams and Calvin Smith, all of Marysville.

SAN FRANCISCO—The Stauffer Chemical Co., 624 California St., manufacturer of sulphur products, etc., has tentative plans under consideration for the reconstruction of its building on Kearny St., recently destroyed by fire, with loss reported in excess of $75,000. The power house at the works was destroyed.

Florida

JACKSONVILLE—The Garage Equipment Co., 732 West Adams St., recently organized, is planning for the installation of machinery in a local building for the manufacture of chemical polishes, cements, and kindred specialties. L. P. Weathers is president; and O. T. Edwards, vice-president.

Georgia

ATLANTA—The Atlanta Glass Mfg. Co., recently organized with a capital of $500,000, has plans under way for the construction of a local plant for the manufacture of glass bottles, containers, etc. F. J. Cooledge, Jr., is president.

Idaho

SANDPOINT—The Lakeview Silver Mines Co., operating at the Conjecture mine, has tentative plans under consideration for the construction of a new concentrating mill, estimated to cost approximately $80,000.

Illinois

CHICAGO—Pratt & Lambert, Inc., 10 South LaSalle St., manufacturer of paints, varnishes, etc., has awarded a contract to P. J. & J. W. O'Connor, 189 West Madison St., for the construction of a 2-story addition to its plant, on North 26th St. near Princeton Ave., 50x150 ft., estimated to cost about $60,000.

ROCK ISLAND—The Service Rubber Co., 401 Central Trust Bldg., has commenced excavations for its proposed new 3-story plant on 2nd St., near 11th St., 60x300 ft., estimated to cost about $100,000, including equipment. Vervin & Horn, 311 Safety Bldg., are architects.

CHICAGO—The Swigart Paper Co., 653 South Wells St., has construction under way on a new 10-story and basement building at 715 South Wells St., 92x100 ft., to be used in connection with local operations, estimated to cost close to $500,000.

GRANITE CITY—The proposed new addition to be constructed at the local plant of the National Enameling & Stamping Co., estimated to cost about $1,500,000, will be used for increased production of coke and pig iron, and for the utilization of a greater number of byproducts from the coke ovens. The structures will include a coke-oven building, enlargement in blast furnaces, and extensions in the main steel plant, with new 3-story plate mill, 54x150 ft. Contract for the latter has been awarded to the St. Louis Structural Steel Co., National Bank of Commerce Bldg., St. Louis, Mo.

Indiana

GARY—The National Tube Co., Frick Bldg., Pittsburgh, Pa., has awarded a general contract to the Mellon-Stuart Co., Oliver Bldg., Pittsburgh, for the construction of its proposed new tube mill on the lake front at Gary. The works will consist of a number of furnaces with lap mills, butt mills and skelp mills, and are estimated to cost approximately $10,000,000, with machinery. The company is also perfecting plans for the early construction of a new battery of 140 coke ovens at this same location.

Kansas

LYONS—The Bevis Salt Co., Lyons, has plans under way for the construction of a new evaporating plant on local site, estimated to cost about $175,000, including equipment. A power house will be built and two electric turbines and auxiliary operating machinery installed.

Louisiana

SHREVEPORT—The Shreveport Brick & Tile Co. has acquired a tract of land on Douglass Island, comprising about 100 acres, as a site for the construction of a new plant for the manufacture of pressed brick and other burned clay products. The equipment installation will provide for an initial output of about 750,000 bricks per day. J. W. Peyton is president.

Maryland

BALTIMORE—The James Robertson Lead Works, Inc., 827 South Howard St., a subsidiary of the United Lead Co., 111 Broadway, New York, N. Y., has awarded a general contract to the Consolidated Engineering Co., 243 Calvert Bldg., Baltimore, for the construction of an addition to its plant on South Howard St. Charles E. McPhail is manager.

BALTIMORE—The White Co., 206 Water St., manufacturer of paints, varnishes, etc., has plans nearing completion for the construction of a 3-story addition to its plant, to be equipped for general production.

BALTIMORE—The Maurice Chemical Co., 1427 Washington Blvd., D. E. Collins, president, recently organized, has plans under way for the establishment of a local plant to manufacture refractory and high-temperature furnace cements, and other products. A list of equipment to be installed is being prepared.

Michigan

PORT HURON—The Egyptian Portland Cement Co., Fenton, has leased the former

car shops of the Grand Trunk Railway Co. at Port Huron. Possession will be taken at once and the existing buildings remodeled and improved, and new machinery installed. It is planned to have the mill ready for service early in the coming year.

FLAT ROCK—The Ford Motor Co., Highland Park, will call for bids before the close of the present month for the construction of its proposed 1- and 2-story plant at Flat Rock, for the manufacture of plate glass. It is estimated to cost close to $1,000,000, with machinery. Albert Kahn, 1000 Marquette Bldg., Detroit, is architect.

Minnesota

ST. PAUL—The Minnesota Wax Paper Co., 1832 St. Anthony Ave., will commence the immediate construction of a new 1-story plant on Fairview Ave. near Roblyn St., estimated to cost about $15,000.

Nevada

ELY—The Nevada Consolidated Copper Co. has plans in preparation for the rebuilding of its concentrating plant, known as the McGill concentrator, recently destroyed by fire with loss in excess of $1,000,000. The new mill is estimated to cost approximately a like amount.

New Jersey

JERSEY CITY—The Robert Griffin Co., 151 Westfield Ave., manufacturer of paper products, has filed plans for the erection of a 1-story addition to its plant to cost about $16,000, exclusive of equipment.

TRENTON—The Trent Tile Co., Klagg Ave., has awarded a contract to the N. A. K. Bugbee Co., 206 East Hanover St., for the erection of a 1-story building at its plant, 48x166 ft.

TRENTON—The Healey Bedson Pottery Co., recently organized with a capital of $100,000, to manufacture sanitary ware, has acquired property in Ewing Township, fronting on the line of the Philadelphia & Reading Ry., and has plans under way for the construction of a new plant. Work will be commenced at an early date. The company is headed by Stephen J. Healey, Sr. and Jr., and J. Harry Bedson, all of Trenton. Andrew S. Healey, 303 Washington Ave., Elizabeth, N. J., also an incorporator, represents the company.

NEWARK—The Essex Foundry, Murray St. manufacturer of iron castings, has commenced the construction of a 1-story addition, 84x110 ft.

New York

CHAPPAQUA—The F. W. Kraft & Sons Co., Kraft Ave., Bronxville, N. Y., manufacturer of leather products, has awarded a contract to the Blaw-Knox Co., 30 East 42nd St., New York, for the construction of a new 1-story tannery, 50x400 ft., at Chappaqua, estimated to cost approximately $55,000. F. W. Kraft is president.

LOCKPORT—The Lockport Foundries Corp. has preliminary plans under way for the construction of a number of new buildings at its plant. The capacity will be increased. Robert E. Bryant is treasurer and general manager.

North Carolina

BILTMORE—The Felstone Co., 326 Haywood Bldg., Asheville, N. C., has completed plans and will soon commence the construction of a new plant at Biltmore, for the manufacture of ornamental concrete products. The equipment installation will comprise grinding and mixing machinery, screens, polishing apparatus, etc. The initial structure will be 56x112 ft. C. Marshall Gravatt is president.

ASHEVILLE—The Southern Spar & Mica Co., Haywood Bldg., has plans in progress for the construction of an addition to its local plant, for the manufacture of artificial marble products.

WILMINGTON—The City Council will soon commence the construction of a new filtration plant at the municipal water works.

Ohio

AKRON—The Falor Mfg. Co., recently organized, is arranging for the immediate operation of a new local plant for the manufacture of automobile tires and tubes, and has leased the plant of the B. & W. Rubber Co. for its initial works. Machinery will be installed at once to provide for an output of about 2,000 tubes per day. Aaron Falor, formerly connected with the Goodyear Tire & Rubber Co., heads the organization.

CLEVELAND—The Otis Steel Co., Leader Bldg., has arranged for the sale of bonds to an amount of $5,000,000, a large portion of the proceeds to be used for the construction of new plant additions. The extensions will include four open-hearth furnaces, sheet bar mill, blooming mill and strip mill, providing for an annual output of about 84,000 tons. It is planned to commence work at an early date, and have the structures ready for service late in 1923. G. Bartol is president.

Pennsylvania

PITTSBURGH—The Air Reduction Sales Co., 1100 Ridge St., manufacturer of commercial oxygen, acetylene, etc., has plans under way for the construction of an addition to its local plant. The company will also erect a new works on property acquired at Birmingham, Ala., to cost in excess of $200,000, with equipment, as well as an addition to its plant at Milwaukee, Wis. Headquarters are at 342 Madison Ave., New York, N. Y.

READING—The Consumers' Gas Co., Reading, has acquired property on Willow Grove Island, in the Schuylkill River, near the city, completing the acquisition of the entire island, and will use the tract for the construction of a new artificial gas manufacturing plant, utilizing bituminous coal as fuel, estimated to cost close to $1,000,000, with equipment. The company is a subsidiary of the United Gas Improvement Co., Broad and Arch Sts., Philadelphia.

ARNOLD—The American Window Glass Co. has preliminary plans under consideration for the rebuilding of the portion of its local glass manufacturing plant, including mechanical and other buildings, destroyed by fire, July 20, with loss in excess of $150,000, with equipment.

CLAIRTON—The Carnegie Steel Co. is said to be planning for the installation of a number of new batteries of byproduct coke ovens, totaling about 800 ovens in all, at its local plant. The project is estimated to cost in excess of $10,000,000.

LOCK HAVEN—The Borough Council has commenced the construction of a new chlorinating plant at the municipal water works. William T. M. Crowley, Pursley Bldg., Lock Haven, is engineer.

Texas

SISCO—The Sweetwater Cotton Oil Co., Sweetwater, Tex., has acquired the local plant of the Sisco Cotton Oil Co., and will take immediate possession of the property. The plant will be improved and operations commenced at an early date.

DALLAS—The Planters' Cotton Seed Products Co. has been organized with a capital of $100,000 to take over and operate the local plant of the Planters' Cotton Oil Co., recently acquired under bankruptcy proceedings. Extensions and improvements will be made and the mill placed in operation for the manufacture of cotton oil products, at an early date. E. L. Flippen, formerly vice-president of the last noted company, heads the new organization. Other officials are W. H. Jasson and Hugh E. Prather.

LAREDO—The Humble Oil Co. and the Pierce Oil Co., operating neighboring distributing plants, are planning for the rebuilding of the portions of their works destroyed by fire July 19, with loss estimated at close to $100,000, including equipment.

Virginia

WEBSTER—The Roanoke Brick Co., Roanoke, Va., has acquired the plant of the Roanoke Brick & Tile Corp. at Webster, and will take immediate possession. A number of improvements will be made to increase the present capacity of about 20,000 bricks per day. The purchasing company was organized recently with a capital of $100,000. W. W. Hobbie is general manager.

COVINGTON—The City Council will commence the immediate installation of a mechanical filtration plant at the municipal waterworks.

Wisconsin

PARK FALLS—The Flambeau Paper Co. has work under way on the rebuilding of its 2-story pulp and paper mill, recently destroyed by fire. The new structure will cost about $100,000, including equipment. Guy Waldo is general manager.

Washington

PRESCOTT—The Portland Flour Co. is reported to be planning for the rebuilding of its local mill, including power house and other mechanical departments, destroyed by fire July 22, with loss estimated at close to $1,000,000, with equipment.

Canada

FORT WILLIAM, ONT.—The Fort William Paper Co. is completing plans and will soon break ground for the construction of a new paper mill, adjoining its local wood pulp plant, estimated to cost about $1,500,000, including machinery. The local council has given the company authority to proceed with the work.

RICE LAKE, MAN.—The Gold Pan Mining Co. has preliminary plans under consideration for the rebuilding of the portion of its mill destroyed by fire July 19.

Mexico

TAMPICO—The Mexican Petroleum Co., Ltd., 120 Broadway, New York, N. Y., has commenced preliminary work for the construction of a new local oil-refining plant, estimated to cost about $2,000,000. A portion of the works will be given over to the production of gasoline, with equipment installation to provide for an output of about 800,000 gal. per day.

Industrial Notes

The Bethlehem Foundry & Machine Co., Bethlehem, Pa., announces that it has acquired all the capital stock, assets and equipment of the Wedge Mechanical Furnace Co. of Philadelphia. Henceforth the design, manufacture and sale of Wedge roasting furnaces will be conducted as a department of the Bethlehem Foundry & Machine Co., Bethlehem, Pa. All correspondence pertaining to roasting furnaces should be addressed to the Wedge Furnace Department of the company. Members of the operating staff of the Wedge Mechanical Furnace Co. have been retained, including Leslie H. Webb, whose services are available in a consulting capacity. The special facilities for laboratory, research and experimental roasting will also be continued. Inasmuch as the Bethlehem Foundry & Machine Co. has built these furnaces under contract for the Wedge Mechanical Furnace Co., it has all the necessary shop facilities to continue production on the same high plane that has characterized past performance. In brief, this change in ownership of the Wedge Mechanical Furnace Co. is no departure from past policies, service or product.

The American Gas Association has announced that its headquarters are located on the 18th floor of the Canadian Pacific Building, 342 Madison Ave., New York City. The telephone number at the new location is Murray Hill 4209.

The Conveyors' Corporation of America, Chicago, Ill. Announces that the Younglove Construction Co., United Bank Bldg., Sioux City, Iowa, has been appointed its representatives for the sale of American trolley carriers in northwestern Iowa, and in South Dakota. The American trolley carrier is equipment for handling coal from cars to storage pile or overhead silos by means of monorail and self dumping buckets.

The Electric Furnace Construction Co., 908 Chestnut Street, Philadelphia, manufacturers of electric furnaces, "Electro" steam boilers, etc., report an increase in capital and the appointment of the following new officers: P. H. Falter, vice-president and treasurer; Arthur G. Dickson, of Dickson, Beitler & McCouch, Philadelphia, vice-president and counsel and of the following new directors: John Gilbert, of Maderia, Hill & Co. William A. Webb, President Empire Coal Mining Co. T. H. Weisenburg. Frank Hodson retains the Presidency of the Company. P. H. Falter, the new vice-president and treasurer, is a graduate of the Engineering Department of the University of Michigan, and until recently has been vice-president and general manager of the Canadian Electro Products Co., at Shawinigan Falls, Quebec, a subsidiary of the Shawinigan Water & Power Co. Prior to his connection with the Canadian Electro Products Co., he had been general manager of the Baltimore Electric Alloys Co., in the manufacture of ferro-silicon and other electric furnace alloys, and for 13 years with the Aluminum Co. of America in various capacities, including design, construction and operation of a number of its plants. Mr. Falter was also general manager of the Shawinigan Electro Metals Co., Montreal, manufacturers of metallic magnesium, and he has also had considerable experience on hydro electric power plant work at Sault Ste. Marie and Shawinigan Falls, Canada.

The W. A. Jones Foundry and Machine Co., Chicago, Ill., announce that C. F. Ford, who for the past several years has been with the Chicago Pulley and Shafting Co. has joined its engineering sales forces. In the near future Mr. Ford will be located in Minneapolis as manager of the Jones branch there. Several years ago when the Jones Co. were in their old plant at North Avenue and Noble Street, Mr. Ford was their transmission engineer and acted in that capacity over an extended period.

New Companies

THE TITAN CEMENT CO., Ackerman, W. Va., has been incorporated with a capital of $500,000, to construct and operate a cement mill in this secteion. The incorporators are W. L. Sperry, J. W. Cook and D. R. Bartz, all of Ackerman.

THE MANUFACTURERS' KID CORP., New York, N. Y., care of the Corporation Guarantee & Trust Co., Land Title Bldg., Philadelphia, Pa., representative, has been incorporated under Delaware laws with capital of $400,000, to manufacture leather. The incorporators are Harold J. Baldwin, New York; J. Albert Barton, Allentown, Pa.; and Franklin Haddock, Lynn, Mass.

THE RAYOLA CHEMICAL CO., Newark, N. J., has been incorporated with a capital of $20,000, to manufacture chemicals and chemical byproducts. The incorporators are James Hughes, Thomas A. Webb and John H. Valentine, 126 Commerce St., Newark.

GREEN BROTHERS, INC., East Providence, R. I., has been incorporated with a capital of $50,000, to manufacture paper products. The incorporators are Frederick M., George F. and Harry E. Green, all of Providence, R. I.

THE SHINGLE-GIBB LEATHER CO., Philadelphia, Pa., has been incorporated with a capital of $180,000, to manufacture leather products. Walton Gibb, 4650 Locust St., Philadelphia, is treasurer.

THE NOVELOID WORKS, INC., New York, N. Y., care of C. S. Lubin, 55 Liberty St., representative, has been incorporated with a capital of $10,000, to manufacture celluloid products. The incorporators are A. Storch, F. Klein and L. K. Wasser.

THE SUMMERS FERTILIZER CO., INC., 210 East Redwood St., Baltimore, Md., has been incorporated with a capital of $150,000, to manufacture fertilizer products. The incorporators are Willis R. Dresser, Walter P. Summers and James E. Totman.

THE TUSCUMBIA COTTON OIL CO., Tuscumbia, Ala., has been incorporated with a capital of $50,000, to manufacture cotton oil products. The incorporators are Leon Reed and N. A. Graham, Jr., Birmingham, Ala.; and W. H. Jasspon, Houston, Tex.

THE EBECO CHEMICAL CO., Newark, N. J., has been incorporated with a capital of $125,000, to manufacture chemicals and chemical byproducts. The incorporators are Charles Yorhum and Joseph Ebert, 13 Margaretta St., Newark.

THE BERTDICK OIL & REFINING CO., care of the Corporation Service Co., Equitable Bldg., Wilmington, Del., representative, has been incorporated under state laws with a capital of $1,350,000, to manufacture refined petroleum products.

THE FREEMAN-HAMPTON OIL CORP., Wichita Falls, Tex., has been incorporated with a capital of $112,000, to manufacture refined petroleum products. The incorporators are J. H. Freeman, J. W. Hampton and Nathaniel Henderson, all of Wichita Falls.

THE SUPERIOR STEEL PRODUCTS, INC., Detroit, Mich., has been incorporated with a capital of $30,000, to manufacture steel products. The incorporators are Harry D. McCullough, Frederick J. B. Sevald and James A. Dompier, 9367 Navarre Ave., Detroit.

THE HENRY A. DEWEY CO., New York, N. Y., care of Moffatt & Devlin, 342 Madison Ave., representative, has been incorporated with a capital of $20,000, to manufacture chemicals, paints, etc. The incorporators are H. L. Dewey, S. M. Moffatt and E. I. Devlin, Jr.

THE BURKHART-SCHIER CHEMICAL CO., Chattanooga, Tenn., has been incorporated with a capital of $60,000, to manufacture chemicals and chemical byproducts. The incorporators are A. C. Burkhart, M. E. Lane and John H. Cantrell, all of Chattanooga.

THE WEBBER-WOOD SPAR MINING CO., 911 Third St., Eldorado, Ill., has been incorporated with a capital of $50,000, to operate feldspar properties and mills. The incorporators are C. E. Webber, D. L. Wood and A. H. Kinsall.

H. C. ZEAMER, INC., Pleasantville, Pa., care of the Capital Trust Co. of Delaware, Dover, Del., representative, has been incorporated under Delaware laws with capital of $500,000, to manufacture chemicals and affiliated products. The incorporators are H. C. and M. M. Zeamer, Pleasantville; and John E. Engle, Harrisburg, Pa.

THE FLINT STEEL CO., Davison Rd., Flint, Mich., has been incorporated with a capital of $75,000, to manufacture steel products. The incorporators are Edward H., Richmond S. and William L. Perkins, 1603 Garland St., Flint.

THE GRAY BROTHERS OIL CORP., Oklahoma City, Okla., has been incorporated with a capital of $50,000, to manufacture petroleum products. The incorporators are R. R. and C. C. Gray, both of Oklahoma City.

THE MELVILLE FERTILIZER CO., Tampa, Fla., has been incorporated with a capital of $100,000, to manufacture commercial fertilizers. Herbert M. Benker is president; Clarence W. Nelson, vice-president; and Fremont C. Stevens, secretary, all of Tampa.

THE T. H. E. HANOVER CHEMICAL CO., Hanover, Ind., has been incorporated with a capital of $6,000, to manufacture chemicals and chemical byproducts. The incorporators are James O. Taff, Charles A. Hunt and Earl Eldridge, all of Hanover.

THE LITTLE WONDER PRODUCTS CO., Burgettstown, Pa., care of the Corporation Guarantee & Trust Co., Land Title Bldg., Philadelphia, Pa., has been incorporated under Delaware laws, with a capital of $500,000, to manufacture washing compounds and kindred products. The incorporators are K. D. and John J. Downey and H. A. McLain, all of Burgettstown.

THE STATES OIL CO., Room 815, 118 North LaSalle St., Chicago, Ill., has been incorporated with a capital of 50 shares of stock, no par value, to manufacture refined oil products. The incorporators are G. A. Buresh and Louis I. Gottlieb.

THE MELCHERS FULLERS EARTH CORP., San Antonio, Tex., has been incorporated with a capital of $100,000, to operate mining and refining plants for the production of fullers earth and affiliated products. The incorporators are L. L. Shropshire, F. J. Dykstra and E. G. Potter, all of San Antonio.

THE CAPE FEAR FERTILIZER CO., Fayetteville, N. C., has been incorporated with a capital of $150,000, to manufacture fertilizer products. The incorporators are R. E. Nimocks, A. L. McCaskill and A. H. Slocumb, all of Fayetteville.

THE WILSON OIL CORP., New York, N. Y., care of the United States Corporation Co., 65 Cedar St., representative, has been incorporated with a capital of $250,000, under Delaware laws, to manufacture petroleum products.

THE BRUMUND BROTHERS-HUFKER FOUNDRY, INC., 4406 West Carroll Ave., Chicago, Ill., has been incorporated with a capital of $5,000, to manufacture steel, iron and other metal castings. The incorporators are Henry O. and Elmer G. Brumund and John Hufker.

THE SUNSHINE SOAP CO., Shreveport, La., has been incorporated with a capital of $100,000, to manufacture soap products. W. A. Vickers is president; R. L. Mayfield, vice-president; and J. M. Crimmett, secretary, all of Shreveport.

THE BRIGHTON ELECTRIC STEEL CASTING CO., Beaver Falls, Pa., has been incorporated with a capital of $25,000, to manufacture steel and other metal castings. Earl D. Townsend, Beaver Falls, is treasurer.

THE DUNDEE FERTILIZER CO., Winter Haven, Fla., has been incorporated with a capital of $25,000, to manufacture fertilizer products. W. T. Overstreet is president; and Bradford D. Williams, secretary, both of Winter Haven.

THE GULF SUPERIOR PETROLEUM CORP., Chicago, Ill., care of the Colonial Charter Co., Ford Bldg., Wilmington, Del, representative, has been incorporated under Delaware laws with capital of $3,000,000, to manufacture refined petroleum products. The incorporators are George J. Woods, M. S. Gregory and H. Wunderlin, Chicago.

THE NIAGARA FALLS SMELTING & REFINING CO., Niagara Falls, N. Y., care of the Corporation Service Co., Equitable Bldg., Wilmington, Del., representative, has been incorporated under Delaware laws, to manufacture refined metals. The incorporators are Thomas J. Beardmore and Arthur Murphy, Paterson, N. J.

THE ROTHERT PROCESS STEEL CO., 622 Othello St., Seattle, Wash., has been incorporated with a capital of $1,000,000, to manufacture steel products.

THE WELLINGTON PETROLEUM CORP., New York, N. Y., care of the United States Corporation Co., 65 Cedar St., representative, has been incorporated under Delaware laws with capital of $1,000,000, to manufacture petroleum products.

THE ALLIED CHEMICAL CO., Dallas, Tex., has been incorporated with a capital of $60,000, to manufacture chemicals and chemical byproducts. The incorporators are K. C. Scott, W. B. Sparkman and A. B. Farrington, all of Dallas.

THE GRAHAM CLAY PRODUCTS CO., Conneaut, O., has been chartered under state laws to manufacture brick and other burned clay specialties. The incorporators are Charles Follett and John W. Eckelberry, both of Conneaut.

Manufacturers' Catalogs

THE MCALEAR MFG. CO., 1901-7 S. Western Ave., Chicago, Ill., has ready for distribution a new 128-page catalog, known as No. 27, which illustrates many new devices, including an individual temperature control valve, specialties for all power plants, vacuum and vapor heating system, oil refining and waterworks plants, plumbing systems and marine service, together with illustrations showing their application and use. The individual temperature control valve is self-contained and can be applied to any radiator, old or new, without additional piping other than the supply and return. When the thermostatic member is set for the desired room temperature, it automatically controls the opening and closing of the valve. The catalog contains a very comprehensive detailed description of all specialties.

THE UEHLING INSTRUMENT CO., Paterson, N. J., has issued Bulletin 113, on "Preparing Flue Gas for Analysis."

THE YALE & TOWNE MFG. CO., Stamford, Conn., has issued a revised price list of trolleys, cranes, switches, etc., which are illustrated and described in Yale Catalog 20D.

COOPER-HEWITT ELECTRIC CO., Hoboken, N. J., is distributing Bulletin 104, by L. J. Buttolph, on "Lab-Arc," a monochromatic light.

E. J. CODD CO., Baltimore, Md., in a new bulletin describes chain screen doors for furnaces and ovens, which have found application in metallurgical, glass, chemical and boiler furnaces. The screen consists of a multitude of individual strands of steel chain, forming a penetrable transparent sheet of chain, which does not interfere with the view of the interior of the furnace, the passage of the charge, or the tools necessary for manipulation of the same.

THE NORTHERN ENGINEERING WORKS, Detroit, Mich., announces the publication of a condensed catalog showing a few standardized designs of electric hoists.

THE TRUSCON LABORATORIES, Detroit, Mich., calls attention to a very attractive "Architects Specification Handbook" which has just come off the press. This book has 108 pages, approximately 8½x11 in. The binding is loose leaf, making the set of specifications adaptable for use either as a reference book for the A.I.A. filing system or for any other classification adopted by the architect's or engineer's office. It contains complete specifications on waterproofings, damp-proofings and technical coatings.

Coming Meetings and Events

ALPHA CHI SIGMA dinner, during the Chemical Exposition, will be held Thursday, Sept. 14, at 6:30 p.m. at Keen's Chop House, 107 West 44th St., New York City.

AMERICAN CERAMIC SOCIETY will hold a summer excursion meeting to Rochester, Montreal, Ottawa, Kingston, Toronto, Hamilton, Niagara Falls and Buffalo, Aug. 13-19.

AMERICAN CHEMICAL SOCIETY will hold its fall meeting in Pittsburgh, Pa., Sept. 5 to 9.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its fall meeting in Montreal, Sept. 21, 22 and 23. Headquarters will be at the Windsor Hotel.

AMERICAN GAS ASSOCIATION will hold its annual convention and exhibition at Atlantic City, Oct. 23 to 28.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS will hold its 126th meeting at San Francisco, Calif., Sept. 25-29, 1922.

AMERICAN SOCIETY FOR STEEL TREATING will hold its International Steel Exposition and Convention in the General Motors Bldg., Detroit, Mich., Oct. 2 to 7.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (EIGHTH) will be held in New York Sept. 11-16.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING will be held at the Grand Central Palace Dec. 7-13, with the exception of the intervening Sunday.

NATIONAL SAFETY COUNCIL will hold its Eleventh Annual Safety Congress in Detroit, Aug. 28 to Sept. 1.

NEW JERSEY CHEMICAL SOCIETY has discontinued meetings for the summer, but will resume them in October.

THE SOCIETY OF INDUSTRIAL ENGINEERS will hold its next national convention and exhibitions of labor-saving equipment at the Hotel McAlpin, New York, Oct. 18, 19 and 20.